Subsurface Exploration, Geologic Hazard, and Geotechnical Engineering Report

PENNY LANE II & III

Redmond, Washington

Prepared For:

ICHIJO USA CO., LTD.

Project No. 20180106E001
April 16, 2019
Revised November 19, 2019

Associated Earth Sciences, Inc.
911 5th Avenue
Kirkland, WA 98033
P (425) 827 7701

April 16, 2019
Revised November 19, 2019
Project No. 20180106E001

Ichijo USA Co., Ltd.
15135 NE 90th Street, Suite 200
Redmond, Washington 98052

Attention: Mr. Randy Barnett

Subject: Subsurface Exploration, Geologic Hazard, and
Geotechnical Engineering Report
Penny Lane II & III
Redmond, Washington

Dear Mr. Barnett:

Associated Earth Sciences, Inc. (AESI) is pleased to present this report providing the results of our Subsurface Exploration, Geologic Hazard, and Geotechnical Engineering Report for the above-referenced site. This report has been prepared for the exclusive use of Ichijo USA Co., Ltd. and their agents, for specific application to this project.

We have enjoyed working on this study and are confident that the recommendations presented in this report will aid in the successful completion of your project. If you should have any questions, or if we can be of additional help to you, please do not hesitate to call.

Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
Kirkland, Washington

____
Bruce L. Blyton, P.E.
Senior Principal Engineer

BLB/ms - 20180106E001-13

SUBSURFACE EXPLORATION, GEOLOGIC HAZARD, AND GEOTECHNICAL ENGINEERING REPORT

PENNY LANE II & III

Redmond, Washington

Prepared for:
Ichijo USA Co., Ltd.
15135 NE 90th Street, Suite 200
Redmond, Washington 98052

Prepared by:
Associated Earth Sciences, Inc.
911 5th Avenue
Kirkland, Washington 98033
425-827-7701

April 16, 2019
Revised November 19, 2019
Project No. 20180106E001

I. PROJECT AND SITE CONDITIONS

1.0 INTRODUCTION

This report presents the results of Associated Earth Sciences, Inc's. (AESI) subsurface exploration, geologic hazard, and geotechnical engineering study for the proposed new multi-family residential development. The location of the site is shown on the "Vicinity Map," Figure 1. The approximate locations of explorations completed for this study, along with existing site features, are shown on the "Existing Site and Exploration Plan," Figure 2. The approximate locations of explorations, along with proposed site features, are shown on the "Proposed Site and Exploration Plan," Figure 3. Interpretive exploration logs are included in the Appendix A. The conclusions and recommendations contained in this report should be reviewed and modified, or verified, if project plans change substantially. For preparation of this report we were provided with plan sets for "Penny Lane II" and "Penny Lane III," prepared by CORE Design, dated August 29, 2019. AESI has also prepared a "Critical Aquifer Recharge Areas Report," dated April 17, 2019, (AESI, 2019) to address City of Redmond requirements for critical areas.

1.1 Purpose and Scope

The purpose of this study was to provide subsurface data to be used in the design of the project. Our study included a review of selected geologic literature, completion of four exploration borings with a track-mounted hollow-stem auger drill rig, completion of ten exploration pits with a track-mounted excavator, and performance of geologic studies to assess the type, thickness, distribution, and physical properties of the subsurface sediments and shallow groundwater. Geotechnical engineering and hydrogeologic studies were completed to formulate our recommendations for site preparation, site grading, construction, stormwater infiltration, and drainage. This report summarizes our current fieldwork and offers recommendations for development based on our present understanding of the project. We recommend that we be allowed to review any revisions to project plans to verify that our geotechnical engineering and hydrogeologic recommendations have been correctly interpreted and incorporated into the design.

1.2 Authorization

This report has been prepared for the exclusive use of Ichijo USA Co., Ltd. and their agents for specific application to this project. Our work was performed in accordance with our scope of work and cost proposal dated March 7, 2018. We were authorized to proceed by means of a consultant agreement.

Within the limitations of scope, schedule, and budget, our services have been performed in accordance with generally accepted geotechnical engineering and engineering geology practices in effect in this area at the time our report was prepared. No other warranty, express or implied, is made.

2.0 PROJECT AND SITE DESCRIPTION

The subject site consists of King County Tax Parcel Nos. 7792900-115, -125, -130, and -140, located along 170th Avenue NE immediately south of NE 80th Street, in Redmond, Washington. The parcels are rectangular shaped in plan view and have a total approximate area of 0.8 acres combined. Each parcel is occupied by a single-family residence, garage, paved parking and driveway, lawn areas, and landscaping. Site topography across the parcels is relatively flat with overall vertical relief estimated at 10 feet. The project area lies within the City of Redmond's Wellhead Protection Zone 1. AESI has completed a Critical Areas report (AESI, 2019), which addresses the City of Redmond Requirements for a Critical Aquifer Recharge Area (CARA) report.

We understand the project will consist of, at-grade, row-house-style townhomes across the four adjacent lots and arranged into two separate structures, referred to as Penny Lane II and Penny Lane III. The townhomes will be supported by conventional spread footings. Two infiltration trenches are proposed at the project site—one along each new townhome building. Other site improvements will include sidewalks, landscaping, at-grade parking and utilities.

3.0 SUBSURFACE EXPLORATION

AESI conducted several rounds of explorations at the project site. Exploration borings EB-1 through EB-4 were completed at the site on March 28, 2018 and March 29, 2018 and were completed with a track-mounted hollow-stem auger drill rig. Exploration Pits EP-1 through EP-10 were completed at the project site on April 22, 2018, and February 28, 2019, and were completed with a track-mounted excavator. The locations of the exploration borings shown on the "Existing Site and Exploration Plan" (Figure 2) and "Proposed Site and Exploration Plan" (Figure 3) were estimated based on approximate distances from existing site features. Interpretive exploration logs are presented in the Appendix A.

The conclusions and recommendations presented in this report are based on the explorations completed for this study. The number, locations, and depths of our explorations were completed within site and budgetary constraints.

3.1 Exploratory Borings

The exploration borings were completed by advancing hollow-stem auger tools with a track-mounted or trailer-mounted drill rig. During the drilling process, samples were obtained at generally 2½-foot and 5-foot-depth intervals. The exploration borings were continuously observed and logged by a representative from our firm. The exploration logs presented in the Appendix are based on the field logs, drilling action, and inspection of the samples secured.

Disturbed, but representative samples were obtained by using the Standard Penetration Test (SPT) procedure in accordance with *American Society for Testing and Materials* (ASTM) D-1586. This test and sampling method consists of driving a standard 2-inch, outside-diameter, split-barrel sampler a distance of 18 inches into the soil with a 140-pound hammer free-falling a distance of 30 inches. The number of blows for each 6-inch interval is recorded, and the number of blows required to drive the sampler the final 12 inches is known as the Standard Penetration Resistance ("N") or blow count. If a total of 50 is recorded within one 6-inch interval, the blow count is recorded as the number of blows for the corresponding number of inches of penetration. The resistance, or N-value, provides a measure of the relative density of granular soils or the relative consistency of cohesive soils; these values are plotted on the attached exploration boring logs.

The samples obtained from the split-barrel sampler were classified in the field and representative portions placed in watertight containers. The samples were then transported to our laboratory for further visual classification and laboratory testing, as summarized in this report.

3.2 Exploration Pits

The exploration pits were excavated with a track-mounted excavator. The pits permitted direct, visual observation of subsurface conditions. Materials encountered in the exploration pits were studied and classified in the field by a geotechnical engineer from our firm. All exploration pits were backfilled immediately after examination and logging. Selected samples were then transported to our laboratory for further visual classification and testing, as necessary.

4.0 SUBSURFACE CONDITIONS

Subsurface conditions at the project site were inferred from the field explorations accomplished for this study, visual reconnaissance of the site, and review of selected applicable geologic literature. Because of the nature of exploratory work below ground, interpolation of subsurface conditions between field explorations is necessary. It should be noted that differing subsurface conditions may sometimes be present due to the random nature of deposition and the alteration of topography by past grading and/or filling. The nature and extent of any variations between the field explorations may not become fully evident until construction. The general distribution of geologic units is shown on the exploration logs.

The explorations typically encountered surficial alluvial native materials consisting of medium dense sand and gravel sediments. In one of our exploration borings, we encountered pre-Fraser silts underlying the alluvial sands and gravels at a depth of 23 feet below the surface. Three exploration borings and six exploration pits encountered surficial existing fill soils, ranging from 2 feet to greater than 9 feet in thickness.

4.1 Stratigraphy

Fill

Fill soils (those not naturally placed) were encountered in exploration borings EB-1, EB-2, and EB-4, and in exploration pits EP-4 through EP-8 and EP-10. The fill ranged in thickness from 2 feet to greater than 9 feet where encountered. The fill soils generally consisted of sandy silt with trace gravel, and fine to medium sands with varying amounts of silt and gravel. The fill encountered varies in thickness over relatively short horizontal distances. For example, EP-3 encountered no fill soils and EB-4—located less than 20 feet to the east—encountered fill thickness greater than 9 feet. This amount of variability over relatively short distances may be from past excavations, utility trench backfill, demolition of former buildings, or other past construction or grading episodes.

The fines content of fill was highly variable and, where containing relatively high fines, would be considered moisture-sensitive. The existing fill should not be used for infiltration of site stormwater or for support of foundations.

Alluvium

Explorations borings EB-1 and EB-3, as well as all of the exploration pits, encountered native sediments generally consisting of medium dense grading to dense, sandy gravels/gravelly sands with varying amounts of silt. Zones of sand with some silt and some gravel were also encountered, but were less common. The alluvial sediments extended beyond the depths explored except for exploration boring EB-1 where the alluvium was underlain at a depth of 23 feet below the surface by pre-Fraser silts. Holocene alluvium was deposited in streambeds and alluvial fans subsequent to the full recession (melting) of the Vashon-age glacier in the area of the site approximately 12,500 years ago.

Medium dense alluvium is generally suitable for support of light to moderately loaded foundations when properly prepared. Where permeable and unsaturated, the alluvial sediments are a potentially suitable stormwater infiltration receptor. Excavated Holocene alluvium is suitable for reuse in structural fill applications provided all particles over 6 inches in diameter and other deleterious materials are removed. We anticipate that the native alluvial sediments were at or near optimum moisture content for structural fill applications at the time or our explorations.

Pre-Fraser Fine-Grained Sediments

Underlying the alluvium in exploration boring EB-1, we encountered sediments consisting of hard silt with trace sand and gravel. These sediments were encountered at a depth of 23 feet below the surface and extended beyond a depth of 31.5 feet below the surface. These sediments were deposited prior to the Fraser Glaciation of the region. The high relative density characteristic of these sediments is due to their consolidation by the massive weight of the glacial ice that overrode them subsequent to their deposition. Pre-Fraser fine-grained sediments are not expected to provide direct support for structures or hardscapes onsite.

Review of Selected Available Geologic and Soil Data

Review of the regional geologic map titled *Geologic Map of the Redmond Quadrangle* (Derek B. Booth and J.P. Minard, 1988) indicates that the site is underlain by Holocene-age alluvium. This is consistent with our interpretation of the sediments encountered in the explorations completed at the project site.

Review of regional soils mapping (D.E. Snyder, P.S. Gale, and R.F. Pringle, 1973, *Soil Survey of King County Area, Washington*, U.S. Department of Agriculture [USDA], Soils Conservation Service [SCS] now referred to as Natural Resources Conservation Service [NRCS]) indicates that the subject site is underlain by Everett very gravelly sandy loam. Everett soils are formed from the weathering of sandy and gravelly outwash. The native shallow sediments onsite are consistent with the published soils map.

4.2 Hydrology

The site and surrounding vicinity are underlain by a regional unconfined aquifer located within the Holocene alluvium and Vashon recessional outwash deposits found throughout the Sammamish Valley. We encountered groundwater seepage in exploration boring EB-1 at a depth of 22 feet below the surface and is representative of the regional unconfined aquifer.

It should be noted that fluctuations in the level of the groundwater can occur due to the time of the year, variations in rainfall, on- and off-site land uses, and other factors. Locally perched groundwater can sometimes be present above finer-grained (silt, fine sand) interbeds within the alluvium during and following extended periods of precipitation.

Seasonal High Groundwater Elevation

As stated in our CARA report (AESI, 2019), based on our analysis of long-term water level data from the City monitoring wells, AESI extrapolates a seasonal high groundwater level of up to 32 feet elevation (21 feet bgs) with short-term peaks up to 33 feet elevation at the project site. Further detail on this approach can be found in the referenced report.

We then compared our estimate with the procedure provided in Section 2.9.3.9 of the City of Redmond's *Stormwater Technical Notebook 2019* - Issue 8 (2019 SWTN). The SWTN procedure determines a groundwater high elevation by averaging the highest individual peak groundwater elevations each year for a 5-year period from water level data measured in nearby City wells with data provided by the City of Redmond. AESI obtained continuous water level data dating back to January 2014 for monitoring well MW009 located approximately 650 feet southwest of the project site. We also received biyearly water level data for MW052 located approximately 250 feet to the southwest. Tables 1 and 2 below present the yearly seasonal high groundwater elevations for the last 5 years and the average of those values for MW009 and MW052, respectively.

Table 1
MW009 Yearly Peak Groundwater Elevation

Month/Year	Elevation (feet)
1/2014	31.62
12/2015	32.36
1/2016	31.74
2/2017	30.11
1/2018	28.61
Average	**30.88**

Table 2
MW052 Yearly Peak Groundwater Elevation

Month/Year	Elevation (feet)
1/2014	28.84
1/2015	30.84
1/2016	31.83
2/2017	29.05
1/2018	28.47
Average	**29.81**

The high groundwater elevation provided in our CARA report of 33 feet is more conservative when compared to the averages obtained from wells MW009 and MW052 following the SWTN. Therefore, we recommend that the project uses a groundwater high elevation of 33 feet for infiltration facility design.

4.3 Laboratory Grain-Size Analysis

Three laboratory grain-size (sieve) analyses were performed by AESI's in-house laboratory on representative selected samples collected from AESI's subsurface exploration pits. The grain-size analysis test results are presented in Appendix B and are summarized in Table 3. Based on the ASTM D-2487 Unified Soil Classification System (USCS), the grain-size analysis test results indicate that the alluvial sediments generally correlate to a "Gravel" with a variable fines content generally ranging from 2.4 to 3.9 percent. The gravel content ranged as high as 73 percent, the fines content ranged from 0.6 percent to 4.8 percent.

Table 3
Summary of Grain Size Analyses

Exploration	Depth (feet)	USCS Description	Silt Content by Weight (Measured on #200 Sieve)
EP-1	10	Sandy GRAVEL, trace silt	2.4
EP-4	9	Very sandy GRAVEL, trace silt	3.7
EP-5	4	Sandy GRAVEL, trace silt	3.9
EP-6	6.5	Sandy GRAVEL, trace silt	4.8
EP-7	8	Sandy GRAVEL, trace silt	4.8
EP-8	8	Sandy GRAVEL, trace silt	0.6
EP-9	6	Sandy GRAVEL, trace silt	4.2
EP-10	6	Very sandy GRAVEL, trace silt	3.9

USCS = Unified Soil Classification System

The grain-size distribution data were also transformed to describe the USDA soil texture. The grain-size distributions were normalized to the No. 10 sieve—i.e., the coarse sand and gravel fraction of the sample is discounted and the remainder is taken as 100 percent of the sample. The fines were assessed relative to the No. 270 sieve. For soils with a significant proportion of gravel and coarse sand, the USDA soil texture can overstate the fine-grained texture. The sediments tested were about 68 to 83 percent coarse sand and gravel. The USDA soil texture for the 16 to 26 percent passing the No. 10 sieve primarily correlates to a sandy clay loam to sand. No hydrometers were performed. Soil texture represents the range assuming the fines range from silt to clay.

II. GEOLOGIC HAZARDS AND MITIGATIONS

The following discussion of potential geologic hazards is based on the geologic, slope, and shallow groundwater conditions as observed and discussed herein.

5.0 LANDSLIDE HAZARDS AND MITIGATIONS

It is our opinion that the risk of damage to the proposed structures by landsliding is low due to lack of steep slopes at the project site and vicinity. No detailed slope stability analyses were completed as part of this study, and none are warranted, in our opinion. Based on our review of the City of Redmond Municipal Code, the site vicinity does not contain areas that are considered to be governed by regulations associated with Landslide Hazard Areas.

6.0 SEISMIC HAZARDS AND MITIGATIONS

Earthquakes occur regularly in the Puget Lowland. Most of these events are small and are not felt by people. However, large earthquakes do occur, as evidenced by the 2001, 6.8-magnitude event; the 1965, 6.5-magnitude event; and the 1949, 7.2-magnitude event. The 1949 earthquake appears to have been the largest in this region during recorded history and was centered in the Olympia area. Evaluation of earthquake return rates indicates that an earthquake of the magnitude between 5.5 and 6.0 is likely within a given 20-year period.

Generally, there are four types of potential geologic hazards associated with large seismic events: 1) surficial ground rupture, 2) seismically induced landslides, 3) liquefaction, and 4) ground motion. The potential for each of these hazards to adversely impact the proposed project is discussed below.

6.1 Surficial Ground Rupture

Generally, the largest earthquakes that have occurred in the Puget Sound area are sub-crustal events with epicenters ranging from 50 to 70 kilometers in depth. Earthquakes that are generated at such depths usually do not result in fault rupture at the ground surface. Current research indicates that surficial ground rupture is possible in areas close to the Seattle and South Whidbey Island Fault Zones. Although our current understanding of these fault zones is limited and it is an active area of research, the site lies north of the currently mapped limits of the Seattle Fault Zone and south of the mapped limits of the South Whidbey Island Fault Zone. Therefore, based on current information, the risk of damage to planned improvements as a result of surface rupture due to faulting is low, in our opinion.

6.2 Seismically Induced Landslides

It is our opinion that the risk of damage to the proposed structures by seismically induced landsliding is low due to the lack of significant slopes at the subject site and vicinity.

6.3 Liquefaction

Liquefaction is a process through which unconsolidated soil loses strength as a result of vibrations, such as those which occur during a seismic event. During normal conditions, the weight of the soil is supported by both grain-to-grain contacts and by the fluid pressure within the pore spaces of the soil below the water table. Extreme vibratory shaking can disrupt the grain-to-grain contact, increase the pore pressure, and result in a temporary decrease in soil shear strength. The soil is said to be liquefied when nearly all of the weight of the soil is supported by pore pressure alone. Liquefaction can result in deformation of the sediment and settlement of overlying structures. Areas most susceptible to liquefaction include those areas underlain by non-cohesive silt and sand with low relative densities, accompanied by a shallow water table.

Our explorations suggest that the potential risk of damage to the proposed development by liquefaction is low, due to the large grain-size and depth to groundwater within the alluvial sediments and the high relative densities of the underlying pre-Fraser fine-grained sediments.

6.4 Seismic Site Class (2015 *International Building Code*)

In our opinion, the subsurface conditions at the site are consistent with seismic Site Class "D" in accordance with the 2015 *International Building Code* (IBC), and the publication *American Society of Civil Engineers* (ASCE) 7 referenced therein, the most recent version of which is ASCE 7-10.

7.0 EROSION HAZARDS AND MITIGATION

Based on review of the City of Redmond's map titled "Erosion Hazard Areas Critical Areas Map," the site does not lie within an erosion hazard area. However, the sediments underlying the site generally contain silt and sand that can be sensitive to erosion. In order to reduce the amount of sediment transport off the site during construction, the following recommendations should be followed:

1. Silt fencing should be placed around the lower perimeter of all disturbed area(s). The fencing should be periodically inspected and maintained as necessary to ensure proper function.

2. To the extent possible, earthwork-related construction should proceed during the drier periods of the year and disturbed areas should be revegetated as soon as possible. Temporary erosion control measures should be maintained until permanent erosion control measures are established.

3. Areas stripped of vegetation during construction should be mulched and hydroseeded, replanted as soon as possible, or otherwise protected. During winter construction, hydroseeded areas should be covered with clear plastic to facilitate grass growth.

4. If excavated soils are to be stockpiled on the site for reuse, measures should be taken to reduce the potential for erosion from the stockpile. These could include, but are not limited to, covering the pile with plastic sheeting, the use of low stockpiles in flat areas, and the use of straw bales/silt fences around pile perimeters.

5. Interceptor swales with rock check dams should be constructed to divert stormwater from construction areas and to route collected stormwater to an appropriate discharge location.

6. A rock construction entrance should be provided to reduce the amount of sediment transported off-site on truck tires.

7. All stormwater from impermeable surfaces, including driveways and roofs, should be tightlined into approved facilities and not be directed onto or above steeply sloping areas.

III. DESIGN RECOMMENDATIONS

8.0 INTRODUCTION

Our explorations indicate that from a geotechnical engineering standpoint, the proposed project is feasible provided the recommendations contained herein are properly followed. With the exception of EB-4, the bearing stratum was generally shallow and conventional shallow foundations should be suitable with proper subgrade preparation. Existing fill encountered in our explorations ranges in thickness from 2 feet to greater than 9 feet in EB-4, and will require removal where present under areas of new foundations. Fill soils are also likely to be present around existing structures and buried utilities may require removal and recompaction at the time of construction.

9.0 SITE PREPARATION

Site preparation of building and paving areas should include removal of all grass, trees, brush, debris, and any other deleterious materials. Additionally, the upper, organic topsoil should be removed and the remaining roots grubbed. All existing fill beneath planned foundation areas should be removed. We recommend that we are able to observe the removal of existing fill soils from under areas of new foundation due to the high variability of fill thicknesses, and the difficulty of distinguishing the fill soils from suitable native bearing soils. Buried utilities should be removed from planned foundation areas, and should be abandoned in place or removed from below planned new paving. Any depressions below planned final grades caused by demolition activities should be backfilled with structural fill, as discussed under the "Structural Fill" section of this report. Where existing loose fill or natural sediments are relatively free of organics and near their optimum moisture content for compaction, they can be segregated for reuse as structural fill.

9.1 Temporary and Permanent Cut Slopes

In our opinion, stable construction slopes should be the responsibility of the contractor and should be determined during construction. For estimating purposes, we recommend that temporary, unsupported cut slopes in the existing fill or alluvial soils can be planned at an inclination of 1.5H:1V (Horizontal:Vertical) or flatter. As is typical with earthwork operations, some sloughing and raveling may occur and cut slopes may have to be adjusted in the field. If groundwater seepage is encountered in cut slopes or if surface water is not routed away from temporary cut slope faces, flatter slopes or shoring may be required. In addition, WISHA/OSHA regulations should be followed at all times.

Permanent cut and structural fill slopes should be graded no steeper than 2H:1V. Slopes should be hydroseeded, landscaped, or otherwise protected as soon as possible after grading. Cut slopes in natural soils that must be steeper than 2H:1V should be protected by retaining walls or rockeries. Unreinforced rockeries should not be used to retain fill greater than 3 feet thick.

9.2 Site Drainage and Surface Water Control

The site should be graded to prevent water from ponding in construction areas and/or flowing into excavations. Exposed grades should be crowned, sloped, and smooth drum-rolled at the end of each day to facilitate drainage. Accumulated water must be removed from subgrades and work areas immediately prior to performing further work in the area. Portions of the near-surface, weathered, on-site soils contain a moderate to high percentage of fine-grained material, which makes them moisture-sensitive and subject to disturbance when wet. The contractor must use care during site preparation and excavation operations so that the underlying soils are not softened. Equipment access may be limited, and the amount of soil rendered unfit for use as structural fill may be greatly increased if drainage efforts are not accomplished in a timely sequence.

Final exterior grades should promote free and positive drainage away from planned new buildings at all times. Water must not be allowed to pond or to collect adjacent to foundations or within the immediate building area. We recommend that a gradient of at least 3 percent for a minimum distance of 10 feet from the building perimeters be provided, except in paved locations. In paved locations, a minimum gradient of 1 percent should be provided, unless provisions are included for collection and disposal of surface water adjacent to the buildings.

9.3 Wet Weather Conditions

Portions of the near-surface site soils encountered in our explorations are considered moisture-sensitive. To help mitigate the erosion potential of the site soils, we recommend that construction occur during the dry season. Also, if construction does proceed during an extended wet weather construction period, it is possible the site soils may become disturbed and too wet to use for structural fill.

9.4 Frozen Subgrades

If earthwork takes place during freezing conditions, all exposed subgrades should be allowed to thaw, and then be recompacted prior to placing subsequent lifts of structural fill. Alternatively, the frozen material could be stripped from the subgrade to reveal unfrozen soil prior to placing subsequent lifts of fill. The frozen soil should not be reused as structural fill until allowed to thaw and adjusted to the proper moisture content, which may not be possible during winter months.

10.0 STRUCTURAL FILL

Structural fill will be necessary to establish desired grades and for utility trench backfill. All references to structural fill in this report refer to subgrade preparation, fill type, placement, and compaction of materials, as discussed in this section. In those areas where existing, uncontrolled fill is present, we recommend that it be removed and, where suitable, set aside for reuse. Our recommendations for the placement of structural fill are presented in the following sections.

10.1 Fill Placement

After stripping, planned excavation, and any required overexcavation have been performed to the satisfaction of the geotechnical engineer or their representative, the upper 12 inches of exposed ground should be compacted to a firm and unyielding condition, as determined by the geotechnical engineer or their representative. If the subgrade contains too much moisture, adequate compaction may be difficult or impossible to obtain and should probably not be attempted. In lieu of compaction, the area to receive fill should be blanketed with washed rock, quarry spalls, or crushed recycled concrete to act as a capillary break between the new fill and the wet subgrade. Structural fill should be placed and compacted within 2 percent of the optimum moisture content.

After compaction of the exposed ground is approved, or a free-draining rock course is laid, possibly in conjunction with engineering stabilization fabric, structural fill may be placed to attain desired grades. Structural fill is defined as non-organic soil, acceptable to the geotechnical engineer, placed in maximum, 8-inch loose lifts with each lift being compacted to at least 95 percent of the modified Proctor maximum density using ASTM D-1557 as the standard.

The contractor should note that any proposed fill soils should be evaluated by AESI prior to their use in fills. This would require that we have a sample of the material 72 hours in advance to perform a Proctor test and determine its field compaction standard. Soils in which the amount of fine-grained material (smaller than the U.S. No. 200 sieve) is greater than approximately 5 percent (measured on the minus U.S. No. 4 sieve size) should be considered moisture-sensitive. Use of moisture-sensitive soils in structural fills should be limited to favorable dry weather and near-optimum subgrade moisture conditions.

The on-site soils are generally suitable for use as structural fill, although the siltier fill soils observed in our explorations contained significant amounts of silt and clay, were observed to be above their optimum moisture content for compaction, and are considered moisture-sensitive. Construction equipment traversing the site when the soils are wet can cause considerable disturbance. If fill is placed during wet weather or if proper compaction cannot be obtained due to wet subgrade or soil conditions, an imported, select material consisting of a clean, free-draining gravel and/or sand should be used. Free-draining fill consists of non-organic soil with the amount of fine-grained material limited to 5 percent by weight when measured on the minus U.S. No. 4 sieve fraction and at least 25 percent greater than the No. 4 sieve.

11.0 FOUNDATIONS

Spread footings that are supported on the native alluvial sediments, or a combination of these sediments and structural fill, may be designed with an allowable foundation soil bearing pressure of 3,000 pounds per square foot (psf), including both dead and live loads. An increase of one-third may be used for short-term wind or seismic loading. Perimeter footings should be buried at least 18 inches into the surrounding soil for frost protection. However, all footings must penetrate to the prescribed bearing stratum, and no footing should be founded in or above organic or existing fill soils.

It should be noted that the area bound by lines extending downward at 1H:1V from any footing must not intersect another footing or intersect a filled area that has not been compacted to at least 95 percent of ASTM D-1557. In addition, a 1.5H:1V line extending down from any footing must not daylight because sloughing or raveling may eventually undermine the footing. Thus, footings should not be placed near the edge of steps or cuts in the bearing soils.

Anticipated settlement of footings founded as described above should be on the order of ¾ inch or less. However, disturbed soil not removed from footing excavations prior to footing placement could result in increased settlements. All footing areas should be observed by AESI prior to placing concrete to verify that the design bearing capacity of the soils has been attained and that construction conforms to the recommendations contained in this report. Such inspections may be required by the City of Redmond. Perimeter footing drains should be provided, as discussed under the “Drainage Considerations” section of this report.

12.0 DRAINAGE CONSIDERATIONS

Perimeter footing walls should be provided with a drain at the base of the footing elevation. Drains should consist of rigid, perforated, polyvinyl chloride (PVC) pipe surrounded by washed pea gravel. The level of the perforations in the pipe should be set at or slightly below the bottom of the footing, and the drains should be constructed with sufficient gradient to allow gravity discharge away from the buildings. In addition, all retaining walls should be lined with a minimum, 12-inch-thick, washed gravel blanket, or synthetic drainage mat, which extends to within 1 foot of the surface and is continuous with the footing drain. Roof and surface runoff should not discharge into the footing drain system, but should be handled by a separate, rigid, tightline drain. In planning, exterior grades should be sloped downward away from the structures to achieve surface drainage.

13.0 FLOOR SUPPORT

Slab-on-grade floors may be constructed on undisturbed native soils or structural fill prepared as described in the "Site Preparation" section of this report. The floor should be cast atop a minimum of 4 inches of washed pea gravel or clean, uniformly graded crushed rock to act as a capillary break. The capillary break should be covered by a minimum, 10-mil-thick, vapor barrier to mitigate passage of moisture vapor through the floor.

14.0 FOUNDATION WALLS

All backfill behind foundation walls or around foundation units should be placed as per our recommendations for structural fill and as described in this section of the report. Horizontally backfilled walls, which are free to yield laterally at least 0.1 percent of their height, may be designed using an equivalent fluid equal to 35 pounds per cubic foot (pcf). Fully restrained, horizontally backfilled, rigid walls that cannot yield should be designed for an equivalent fluid of 50 pcf. Walls with sloping backfill up to a maximum gradient of 2H:1V should be designed using an equivalent fluid of 55 pcf for yielding conditions or 75 pcf for fully restrained conditions. If parking areas are adjacent to walls, a surcharge equivalent to 2 feet of soil should be added to the wall height in determining lateral design forces.

As required by the 2015 IBC, retaining wall design should include a seismic surcharge pressure in addition to the equivalent fluid pressures presented above. Considering the site soils and the recommended wall backfill materials, we recommend a seismic surcharge pressure of 8H and 11H psf, where H is the wall height in feet for the "active" and "at-rest" loading conditions, respectively. The seismic surcharge should be modeled as a rectangular distribution with the resultant applied at the midpoint of the walls.

The lateral pressures presented above are based on the conditions of a uniform backfill consisting of excavated on-site soils, or imported structural fill compacted to 90 percent of ASTM D-1557. A higher degree of compaction is not recommended, as this will increase the pressure acting on the walls. A lower compaction may result in settlement of the slab-on-grade or other structures supported above the walls. Thus, the compaction level is critical and must be tested by our firm during placement. Surcharges from adjacent footings or heavy construction equipment must be added to the above values. Footing drains should be provided for all retaining walls, as discussed under the "Drainage Considerations" section of this report.

Proper drainage be provided so that hydrostatic pressures do not develop against the walls. This would involve installation of a minimum 1-foot-wide blanket drain to within 1 foot of finish grade for the full wall height using imported, washed gravel against the walls.

14.1 Passive Resistance and Friction Factors

Lateral loads can be resisted by friction between the foundation and the natural soils or supporting structural fill soils, and by passive earth pressure acting on the buried portions of the foundations. The foundations must be backfilled with structural fill and compacted to at least 95 percent of the maximum dry density to achieve the passive resistance provided below. We recommend the following allowable design parameters:

- Passive equivalent fluid = 250 pcf
- Coefficient of friction = 0.35

15.0 INFILTRATION ASSESSMENT

Based on our review of the above-referenced plans, infiltration of site-derived surface water will include two infiltration trenches to manage runoff from non-pollution-generating surfaces. The infiltration trenches will target the permeable alluvial sediments encountered near the surface or underlying existing fill in our explorations. Infiltration locations where existing fill is present should follow excavation recommendations provided in Section 15.3. Based on our site-specific exploration and laboratory testing, it is AESI's opinion that infiltration is feasible at the project site.

The project will manage stormwater in accordance with the 2019 SWTN and the Washington State Department of Ecology's (Ecology's) 2014 *Stormwater Management Manual for Western Washington* (Ecology Manual). To manage stormwater from non-pollution-generating sources, the project will use Best Management Practices (BMPs) from the Ecology Manual as required by the City's 2019 SWTN.

15.1 Infiltration Design Rate

Using the ASTM D-422 soil grain-size data, with the "Soil Grain-Size Analysis Method" for determining infiltration rates in the 2014 Ecology Manual (also referred to as the Massmann method), the estimated initial short-term infiltration rate for the alluvial deposits is on the order of 57 to over 200 inches per hour. These rates assume depth to groundwater is moderate and the soil layer being characterized has not been compacted.

In our experience, the soil grain-size analysis method in the 2014 Ecology Manual can overestimate the initial short-term (uncorrected) infiltration rate for certain unconsolidated sediments. We estimated infiltration rates using in-house, empirical correlations between grain-size data and previous pilot infiltration tests. This in-house method correlates the grain-size distribution with AESI's library of pilot infiltration tests paired with grain-size distribution data to estimate initial short term infiltration rates. For this site, we recommend using an uncorrected infiltration rate of 45 inches per hour.

Per Table III-3.3.1 of the 2014 Ecology Manual, the short-term infiltration rate must have correction factors applied. The short-term rate must be reduced to account for site variability and number of tests conducted, type of test method, and the potential for long-term clogging due to siltation and bio-buildup.

As described in the 2014 Ecology Manual, the correction factor is applied as follows:

Ksat, design = Ksat, initial * CFv * CFt * CFm

Where: Ksat, initial, represents short-term rate determined from the Grain-Size Method.

CFv: site variability correction factor = **0.65** for general uniformity of on-site alluvial sediments, and the number of tests conducted in the vicinity of the proposed infiltration facility (based upon AESI interpretation of the site conditions encountered).

CFt: test method uncertainty correction factor = **0.4** for Grain-Size Method (prescriptive value from the 2014 Ecology Manual).

CFm: correction factor for degree of influent control to prevent siltation and bio-buildup = **0.9** for typically maintained facilities (prescriptive value from the 2014 Ecology Manual).

The design infiltration rate based on these factors is **10.5 inches per hour (in/hr).**

Ksat, design = 45 in/hr * 0.65 * 0.4 * 0.9 = 10.5 in /hr

15.2 Infiltration Facility Setback

Infiltration facility layout for Penny Lane II propose an infiltration trench no closer than 5 feet from the new building. In our opinion, the horizontal setback distance from the new building to the infiltration trench is suitable.

Infiltration facility layout for Penny Lane III proposes an infiltration trench that is no closer than 6 feet from the main building wall of the new building, but within 2 feet of the ends of two wing walls that will extend from the main building toward the facility. We understand that project sequencing proposes that the wing walls will be constructed before the infiltration trench is installed. To avoid undermining of the wing walls adjacent to the infiltration trench, we recommend that the wing wall foundations are deepened to be within 1 foot vertically from the bottom of infiltration trench subgrade. Excavation of infiltration facilities should follow the temporary excavation recommendations provided in Section 9.1.

15.3 Stripping and Subgrade Overexcavation

Existing fill soils 2 to 9 feet in thickness were encountered in areas of the project site. The fill thicknesses varied over small horizontal distances based on our explorations. We recommend that the infiltration facility base be stripped of topsoil and excavated through the upper topsoil/fill to expose a minimum of 1 foot of the underlying coarse-grained alluvial sediments. We recommend that AESI observe the construction of all infiltration trenches to confirm that they are properly situated in permeable native soils.

Stripping and overexcavation should be performed in a manner that does not disturb the underlying receptor horizon. In addition, the subsequent placement of washed import free-draining aggregate on the areas proposed for infiltration should be completed in a manner which minimizes impacts to the framework and density of the native soil. Use of heavy equipment in the areas proposed for infiltration has the potential to compact the subgrade and reduce infiltration potential. As such, we recommend using an excavator with a toothed-edge bucket to strip and scarify the subgrade without tracking over it. An excavator should also be used to initially place the aggregate material over the stripped subgrade to reduce the potential for disturbance. Construction activity on the surface that results in compaction of the native soil will have a detrimental effect on the infiltration rate.

15.4 Imported Fill

Imported fill for infiltration trench will include washed 1½- to 3-inch washed rounded gravel per the referenced civil plans. The infiltration trench gravel backfill is also recommended as backfill below the facility design depth in areas where overexcavation is required due to existing fill that extends below the facility design subgrade. The specified gravel backfill is recommended in Volume III, Section 3.3.11 “Infiltration Trenches,” of the Ecology Manual for use as a permeable backfill within infiltration trenches and has a significantly higher infiltration rate than the native sediments. The infiltration rate for the gravel backfill can be conservatively assumed to be equal to the native soil design infiltration rate of 10.5 in/hr as calculated within Section 15.1 of this report. Use of the specified gravel backfill in places where existing fill is present will not impact a facility design that is sized based on the infiltration rate of the native sediments. The contractor should note that any proposed fill soils must be provided to AESI a minimum of 72 hours prior to placement for conformance with project specifications. The washed aggregate will need to be protected from siltation and sand by proper temporary erosion and sediment control (TESC) practices and management of the imported materials stockpile.

15.5 Protection of Infiltration Facilities During Construction

The infiltration system must remain off-line during construction to avoid siltation. Stormwater runoff must not be routed to the infiltration facility until the site is stabilized and runoff is clear. Imported fill for the underground infiltration facilities will likely include washed aggregate or equivalent.

15.6 Facility Overflow

We recommend an overflow path be specified such that runoff above the facility's design capacity does not cause flooding of a building or emergency access, erosion, downstream sedimentation, or slope failure.

16.0 PROJECT DESIGN AND CONSTRUCTION MONITORING

This report is preliminary in that all of the geotechnical and hydrogeologic engineering aspects of the project have not been fully determined and designed. The City of Redmond will require infiltration testing to confirm the infiltration rate provided in this report. We are available to provide additional geotechnical and hydrogeologic consultation as the project design develops and possibly changes from that upon which this report is based. If significant changes in grading are made, we recommend that AESI perform a geotechnical review of the plans prior to final design completion. In this way, our earthwork and foundation recommendations may be properly interpreted and implemented in the design.

We are also available to provide geotechnical engineering, monitoring services and infiltration testing during construction. The integrity of the infiltration trenches and foundations depend on proper site preparation and construction procedures. In addition, engineering decisions may have to be made in the field in the event that variations in subsurface conditions become apparent. Construction monitoring services are not part of this current scope of work. If these services are desired, please let us know, and we will prepare a cost proposal.

We have enjoyed working with you on this study and are confident these recommendations will aid in the successful completion of your project. If you should have any questions or require further assistance, please do not hesitate to call.

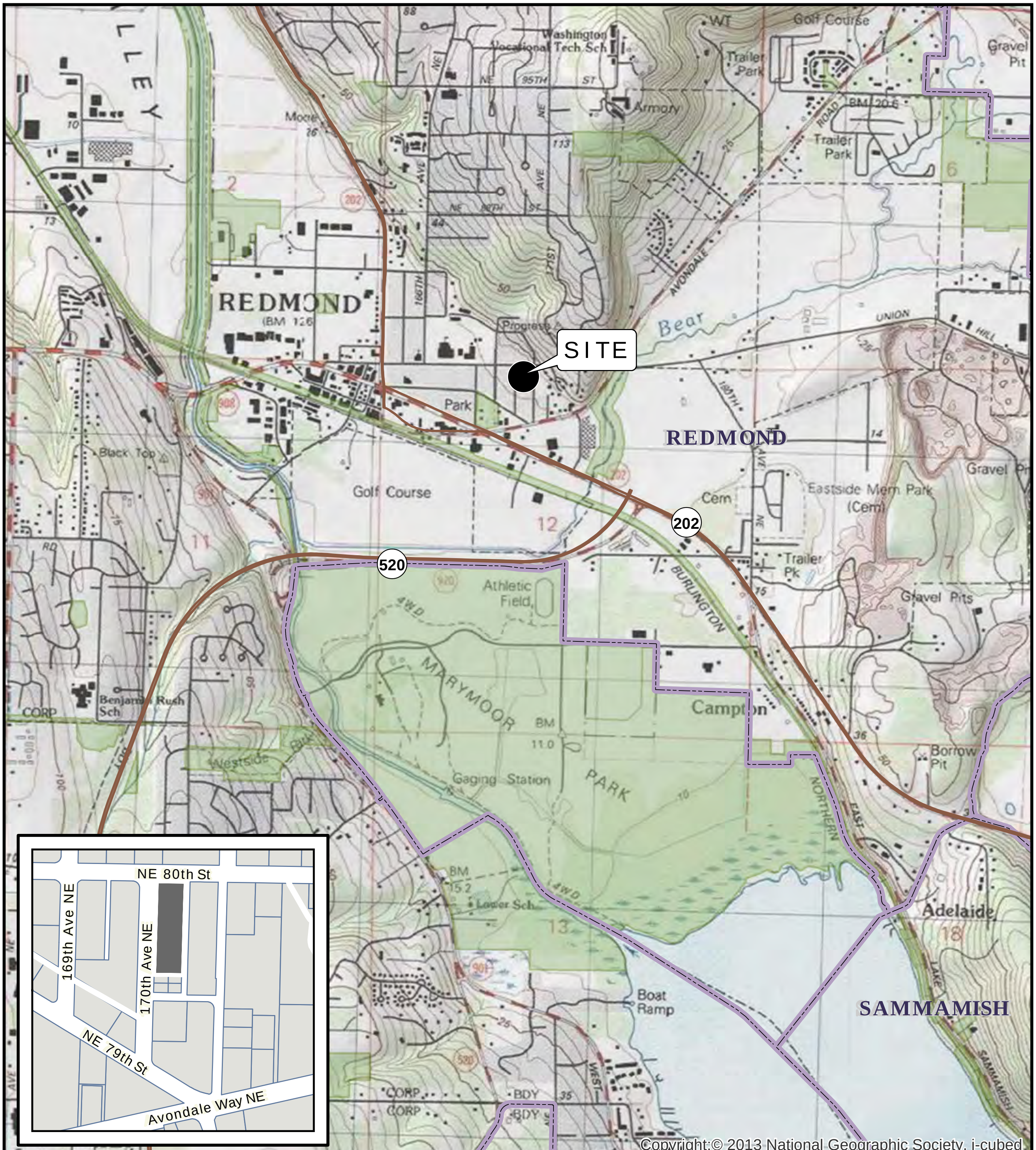
Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
Kirkland, Washington

ANTHONY W. ROMANICK
STATE OF WASHINGTON
51606
REGISTERED
PROFESSIONAL ENGINEER
11-19-19

Bruce L. Blyton, P.E.
Senior Principal Engineer

Anthony W. Romanick, P.E.
Senior Project Engineer

Attachments:
Figure 1. Vicinity Map
Figure 2. Existing Site and Exploration Plan
Figure 3. Proposed Site and Exploration Plan
Appendix A. Exploration Logs
Appendix B. Laboratory Testing Data



DATA SOURCES / REFERENCES:
USGS: 7.5' SERIES TOPOGRAPHIC MAPS, ESRI/I-CUBED/NGS 2013
KING CO: STREETS, PARCELS, CITY LIMITS 1/18

LOCATIONS AND DISTANCES SHOWN ARE APPROXIMATE

N

0 1000 2000
FEET

NOTE: BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION

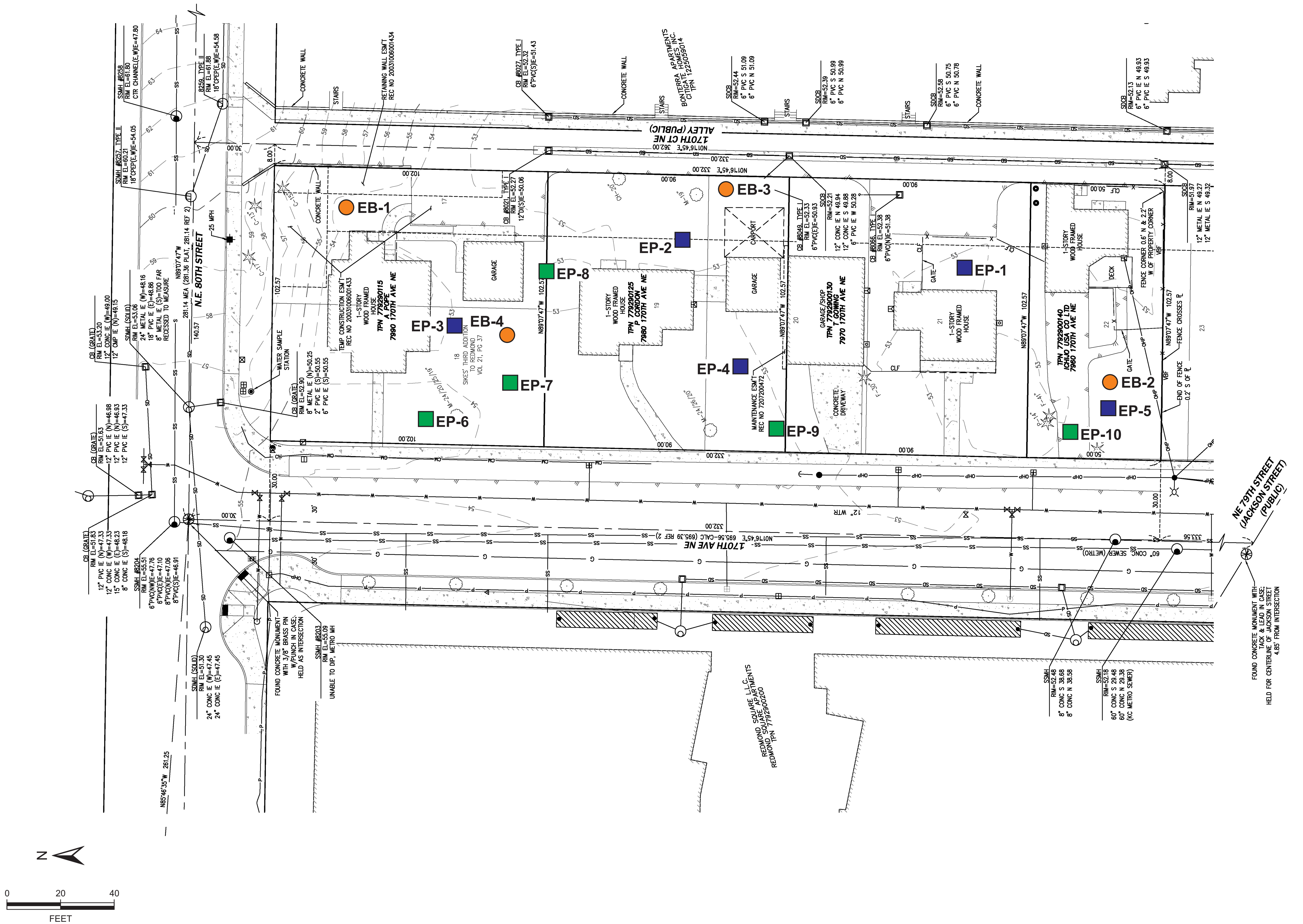
associated earth sciences incorporated

VICINITY MAP

PENNY LANE II
REDMOND, WASHINGTON

PROJ NO.	DATE:	FIGURE:
180106E001	4/18	1

Document Path: G:\GIS_Projects\aaY2018\180106 Penny Lane II\mxd\180106E001 F1 VM_Penny.mxd



LEGEND:

EB EXPLORATION BORING - AESI 3/28/18

EP EXPLORATION PIT - AESI 4/21/18

EP EXPLORATION PIT - AESI 2/28/19

CONTOUR INTERVAL = 1'

NOTE: LOCATION AND DISTANCES SHOWN ARE APPROXIMATE.

NOTES:

1. BASE MAP REFERENCE: CORE DESIGN, ICHIJO USA CO, BOUNDARY AND TOPOGRAPHIC SURVEY GOWING PROPERTY, SHEET 1 OF 1, 10/3/17

BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION.

associated earth sciences incorporated

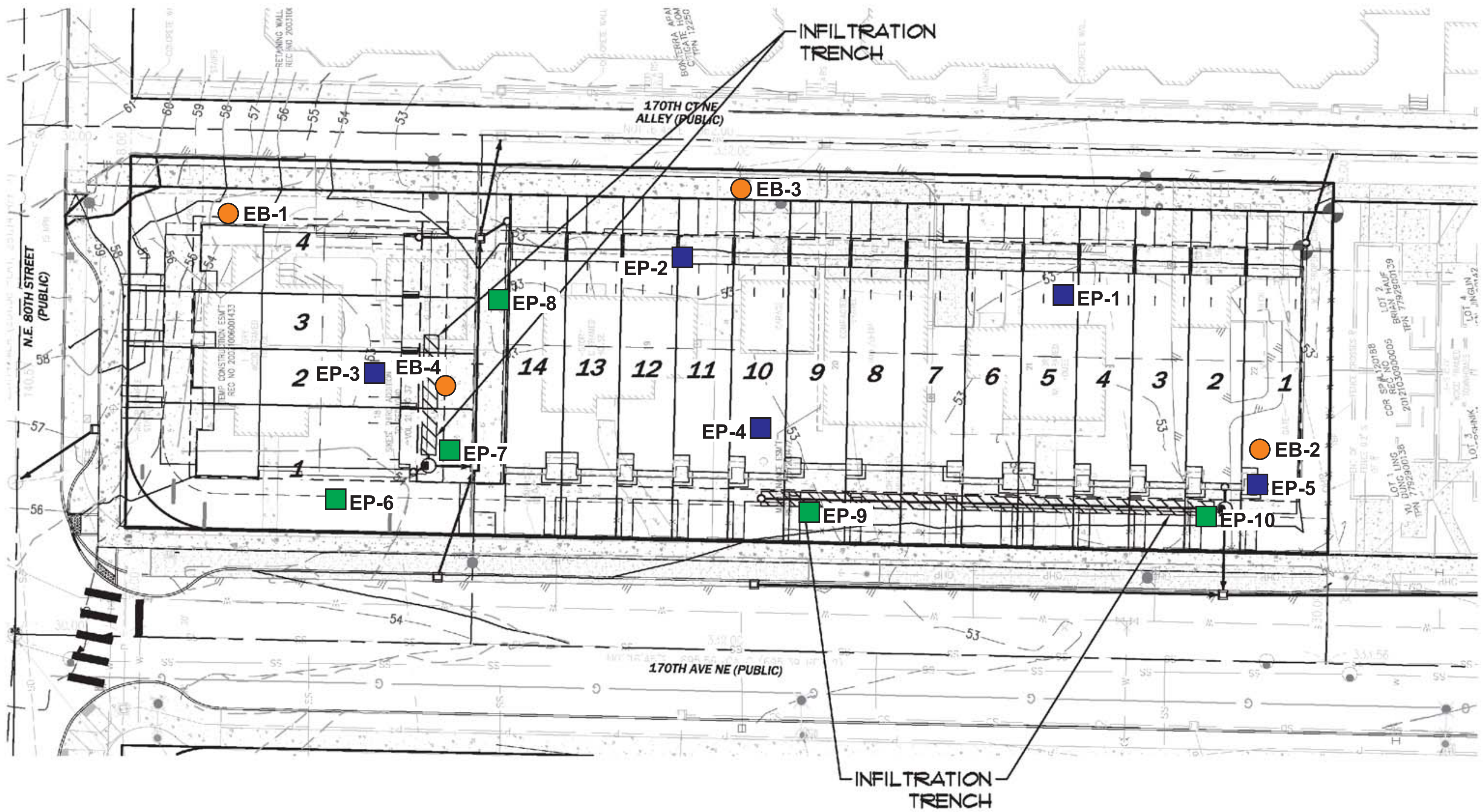
EXISTING SITE AND EXPLORATION PLAN

PENNY LANE II & III

REDMOND, WASHINGTON

PROJ NO.	DATE:	FIGURE:
180106E001	4/19	2

180106 Penny Lane \ 180106E001 F2 S-E 4-19.cdr



LEGEND:

EB	EXPLORATION BORING - AESI 3/28/18
EP	EXPLORATION PIT - AESI 4/21/18
EP	EXPLORATION PIT - AESI 2/28/19

CONTOUR INTERVAL = 1'

NOTE: LOCATION AND DISTANCES SHOWN ARE APPROXIMATE.

NOTES:
1. BASE MAP REFERENCE: CORE DESIGN, PENNY LANE II &III, SITE PLAN, 8/19.

BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION.

associated earth sciences incorporated

PROPOSED SITE
AND EXPLORATION PLAN
PENNY LANE II & III
REDMOND, WASHINGTON

PROJ NO.	DATE:	FIGURE:
180106E001	8/19	3

180106 Penny Lane \ 180106E001 F2 S-E-P 8-19.cdr

APPENDIX A

Exploration Logs

Major Division	Subdivision	Fines	Symbol	Description
Coarse-Grained Soils - More than 50%[1] Retained on No. 200 Sieve	Gravels - More than 50%[1] of Coarse Fraction Retained on No. 4 Sieve	≤5% Fines[5]	**GW**	Well-graded gravel and gravel with sand, little to no fines
			GP	Poorly-graded gravel and gravel with sand, little to no fines
		≥12% Fines[5]	**GM**	Silty gravel and silty gravel with sand
			GC	Clayey gravel and clayey gravel with sand
	Sands - 50%[1] or More of Coarse Fraction Passes No. 4 Sieve	≤5% Fines[5]	**SW**	Well-graded sand and sand with gravel, little to no fines
			SP	Poorly-graded sand and sand with gravel, little to no fines
		≥12% Fines[5]	**SM**	Silty sand and silty sand with gravel
			SC	Clayey sand and clayey sand with gravel
Fine-Grained Soils - 50%[1] or More Passes No. 200 Sieve	Silts and Clays Liquid Limit Less than 50		**ML**	Silt, sandy silt, gravelly silt, silt with sand or gravel
			CL	Clay of low to medium plasticity; silty, sandy, or gravelly clay, lean clay
			OL	Organic clay or silt of low plasticity
	Silts and Clays Liquid Limit 50 or More		**MH**	Elastic silt, clayey silt, silt with micaceous or diatomaceous fine sand or silt
			CH	Clay of high plasticity, sandy or gravelly clay, fat clay with sand or gravel
			OH	Organic clay or silt of medium to high plasticity
Highly Organic Soils			**PT**	Peat, muck and other highly organic soils

Terms Describing Relative Density and Consistency

	Density	SPT[2] blows/foot
Coarse-Grained Soils	Very Loose	0 to 4
	Loose	4 to 10
	Medium Dense	10 to 30
	Dense	30 to 50
	Very Dense	>50

	Consistency	SPT[2] blows/foot
Fine-Grained Soils	Very Soft	0 to 2
	Soft	2 to 4
	Medium Stiff	4 to 8
	Stiff	8 to 15
	Very Stiff	15 to 30
	Hard	>30

Test Symbols

G = Grain Size
M = Moisture Content
A = Atterberg Limits
C = Chemical
DD = Dry Density
K = Permeability

Component Definitions

Descriptive Term	Size Range and Sieve Number
Boulders	Larger than 12"
Cobbles	3" to 12"
Gravel	3" to No. 4 (4.75 mm)
Coarse Gravel	3" to 3/4"
Fine Gravel	3/4" to No. 4 (4.75 mm)
Sand	No. 4 (4.75 mm) to No. 200 (0.075 mm)
Coarse Sand	No. 4 (4.75 mm) to No. 10 (2.00 mm)
Medium Sand	No. 10 (2.00 mm) to No. 40 (0.425 mm)
Fine Sand	No. 40 (0.425 mm) to No. 200 (0.075 mm)
Silt and Clay	Smaller than No. 200 (0.075 mm)

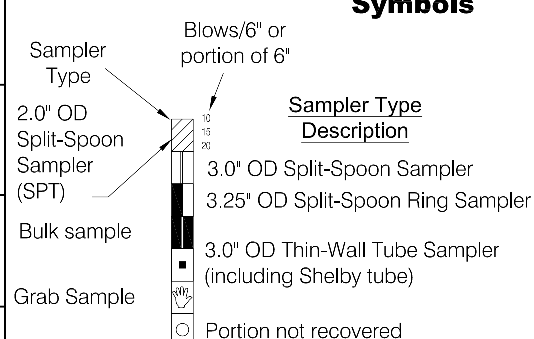
[3] Estimated Percentage

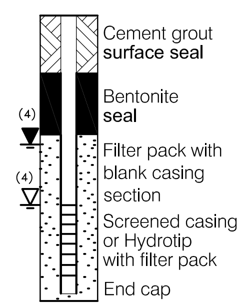
Component	Percentage by Weight
Trace	<5
Some	5 to <12
Modifier (silty, sandy, gravelly)	12 to <30
Very *modifier* (silty, sandy, gravelly)	30 to <50

Moisture Content

Dry - Absence of moisture, dusty, dry to the touch
Slightly Moist - Perceptible moisture
Moist - Damp but no visible water
Very Moist - Water visible but not free draining
Wet - Visible free water, usually from below water table

Symbols





(1) Percentage by dry weight
(2) (SPT) Standard Penetration Test (ASTM D-1586)
(3) In General Accordance with Standard Practice for Description and Identification of Soils (ASTM D-2488)
(4) Depth of ground water
▼ ATD = At time of drilling
▽ Static water level (date)
(5) Combined USCS symbols used for fines between 5% and 12%

Classifications of soils in this report are based on visual field and/or laboratory observations, which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field or laboratory testing unless presented herein. Visual-manual and/or laboratory classification methods of ASTM D-2487 and D-2488 were used as an identification guide for the Unified Soil Classification System.

LOG OF EXPLORATION PIT NO. EP-1

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

Depth (ft)	DESCRIPTION Elev: 53 ft
	Grass - 4 inches
	Alluvium
1	Medium dense, moist, light brown to brown, gravelly, fine to medium SAND, trace silt; weathered horizon; Cobbles (2 to 8 inches in diameter); stratified (SP).
2	
3	
4	Moderate caving.
5	
6	
7	
8	Increased moisture in excavated soils.
9	
10	Medium dense, moist to very moist, light brown to gray, medium to coarse sandy, GRAVEL, trace silt (GW).
11	
12	Very moist.
13	
14	Medium dense, very moist to wet, light brown, gravelly, fine to medium SAND, trace to some silt (SP-SM).
15	
16	Bottom of exploration pit at depth 15 feet No seepage. Moderate caving.
17	
18	

KCTP3 180106.GPJ March 26, 2019

Penny Lane II & III
Redmond, WA

Logged by: TG
Approved by: JHS

associated earth sciences incorporated

Project No. 180106E001

4/21/18

LOG OF EXPLORATION PIT NO. EP-2

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION** Elev: 53 ft
	Grass Turf - 4 inches
	Topsoil - 9 inches
1	Root zone 1 to 2.5 feet
	Alluvium
2	Medium dense, moist, light brown and gray, fine SAND, some gravel, trace silt; minor cobbles (2 to 4 inches in diameter) (SP).
3	
4	Some stratification of fine and coarse gravel.
5	
6	
7	
8	Increased moisture.
9	Medium dense, very moist, gray to brown, gravelly, fine to medium SAND, some silt; silt coated gravel; some stratification (SP-SM).
10	
11	
12	
13	
14	
15	Bottom of exploration pit at depth 14 feet No seepage. Moderate to heavy caving.
16	
17	
18	

KCTP3 180106.GPJ March 26, 2019

Penny Lane II & III
Redmond, WA

Logged by: TG
Approved by: JHS

associated earth sciences incorporated

Project No. 180106E001

4/21/18

LOG OF EXPLORATION PIT NO. EP-3

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

Depth (ft)	DESCRIPTION Elev: 53 ft
	Grass Turf - 4 inches
	Topsoil - 6 inches
1	**Alluvium**
2	Loose, moist, light brown to brown, fine to medium SAND, some gravel, trace silt; some stratification apparent (SP).
3	
4	
5	Denser material at 5 feet, increase in cobbles.
6	
7	Layers of silt.
8	
9	Medium dense, moist, dark brown to gray, fine to medium sandy, GRAVEL, some to trace silt (GP).
10	Heavy caving below 10 feet.
11	Increase in moisture.
12	
13	
14	Larger cobbles (3 to 6 inches in diameter)
15	Medium dense, very moist, dark brown to dark gray, gravelly, fine to medium SAND, some to trace silt (SP-SM).
16	Bottom of exploration pit at depth 15.5 feet No seepage. Moderate caving 0 to 10 feet, heavy caving below 10 feet.
17	
18	

KCTP3 180106.GPJ March 26, 2019

Penny Lane II & III
Redmond, WA

Logged by: TG
Approved by: JHS

associated earth sciences incorporated

Project No. 180106E001
4/21/18

LOG OF EXPLORATION PIT NO. EP-4

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. DESCRIPTION — Elev: 53 ft
	Crushed Rock - 9 inches
1	**Fill** Silty sand with gravel.
2	**Alluvium** Weathered horizon with roots 2 to 4 feet.
3	Loose, moist, brown to reddish brow, silty, fine SAND, some gravel (SM).
4	
5	Obvious stratification.
6	
7	
8	Denser material at 8 feet, larger cobbles (3 to 6 inches in diameter).
9	Medium dense, moist, dark brown to gray, very sandy, GRAVEL, trace silt; predominantly medium to coarse sand (GW).
10	Heavy caving below 9 feet.
11	
12	Increased moisture.
13	
14	
15	Medium dense, very moist, light brown, to gray, gravelly, fine to medium SAND, trace to some silt (SP-SM).
16	Bottom of exploration pit at depth 15 feet No seepage. Moderate caving 0 to 9 feet, heavy caving below 9 feet.
17	
18	

KCTP3 180106.GPJ March 26, 2019

Penny Lane II & III
Redmond, WA

Logged by: TG
Approved by: JHS

associated earth sciences incorporated

Project No. 180106E001
4/21/18

LOG OF EXPLORATION PIT NO. EP-5

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION** Elev: 53 ft
	Grass Turf - 4 inches
	Fill
1	Crushed rock material
2	**Alluvium**
	Black plastic at 2 feet.
3	
4	Medium dense, moist, brown to gray, sandy, GRAVEL, trace silt; large cobbles (3 to 9 inches in diameter) (GP).
5	Medium dense, moist, light brown to brown, medium to coarse sandy, GRAVEL, trace silt; obvious stratification (GP).
6	
7	Tough digging conditions.
8	
9	
10	
11	
12	Increased moisture at 12 feet.
13	
14	Pockets of angular silt blocks encased in alluvium ("rip up clasts").
15	Medium dense, very moist, light brown to gray, gravelly, fine to coarse SAND, trace to some silt (SP-SM).
16	Bottom of exploration pit at depth 16 feet
17	No seepage. Moderate caving 2 to 8 feet, heavy caving below 8 feet.
18	

KCTP3 180106.GPJ March 26, 2019

Penny Lane II & III
Redmond, WA

Logged by: TG

Approved by: JHS

associated earth sciences incorporated

Project No. 180106E001

4/21/18

LOG OF EXPLORATION PIT NO. EP-6

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

Depth (ft)	DESCRIPTION — Elev: 53 ft
	Fill
1	Loose, dry, dark brown, silty, fine to medium SAND, some gravel; abundant organics including large roots and smaller rootlets (SM).
2	
3	Loose, dry to slightly moist, dark brownish red, silty, fine to medium SAND, some gravel; scattered organics (rootlets) (SM).
4	As above.
	Alluvium
5	Medium dense, slightly moist, brown, gravelly, fine to medium SAND, trace silt; minimal organics (rootlets) (SP).
6	
7	Medium dense, moist, brown, fine to coarse sandy, GRAVEL, trace silt (GP).
8	
9	Medium dense, moist, tan to brown, GRAVEL, some medium to coarse sand, trace silt; abundant scattered cobbles ($\geq$ 6 inches) (GP).
10	As above (GP).
11	
12	Bottom of exploration pit at depth 11 feet No seepage. No caving.
13	
14	
15	
16	
17	
18	

KCTP3 180106.GPJ March 26, 2019

Penny Lane II & III
Redmond, WA

Logged by: BCY
Approved by: JHS

associated earth sciences incorporated

Project No. 180106E001
2/28/19

LOG OF EXPLORATION PIT NO. EP-7

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION** Elev: 53 ft
	Fill
1	Loose, slightly moist, dark brown, silty, fine to medium SAND, trace to some gravel; abundant organics (SM).
2	Loose, slightly moist, brown to reddish brown, silty, fine to medium SAND, some gravel; scattered organics (rootlets) (SM).
3	**Alluvium**
4	Loose, slightly moist, brown, medium SAND, some gravel, trace silt (SP).
5	Loose, slightly moist, fine to medium SAND, trace to some gravel, trace silt (SP).
6	
7	
8	Loose to medium dense, slightly moist, brown, fine to medium sandy, GRAVEL, trace silt; minor scattered organics (GW).
9	Medium dense, slightly moist to moist, GRAVEL, some fine to coarse sand, trace silt; scattered cobbles (up to 7 inches); scattered organics (rootlets) (GW).
10	
11	Medium dense, moist, tan to brown, medium to coarse sandy, GRAVEL, trace silt; scattered cobbles (GW).
12	
13	Bottom of exploration pit at depth 12 feet No seepage. No caving.
14	
15	
16	
17	
18	

KCTP3 180106.GPJ March 26, 2019

Penny Lane II & III
Redmond, WA

Logged by: BCY

Approved by: JHS

associated earth sciences incorporated

Project No. 180106E001

2/28/19

LOG OF EXPLORATION PIT NO. EP-8

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

Depth (ft)	DESCRIPTION — Elev: 53 ft
	Fill
1	Loose, dry, dark brown, silty, fine to medium SAND, some gravel; scattered organics and construction debris (SM).
	Alluvium
2	
3	Loose, slightly moist, tan, fine to medium SAND, trace to some gravel, trace silt (SP-SW).
4	Loose to medium dense, slightly moist, tan, fine to coarse SAND, trace to some gravel, trace silt (SP-SW).
5	
6	Medium dense, slightly moist to moist, tan, medium to coarse sandy, GRAVEL, trace silt; scattered cobbles (≥6 inches) (GW).
7	
8	Medium dense, moist, tan, medium to coarse sandy, GRAVEL, trace silt; scattered cobbles (4 to 6 inches); scattered rootlets (GW).
9	
10	As above; sand content coarsening (GW).
11	
12	Medium dense to dense, moist, tannish brown, GRAVEL, some medium to coarse sand, trace silt, trace cobbles; minor scattered organics (GW).
13	Bottom of exploration pit at depth 12.5 feet No seepage. Minor caving at 6 and 11 feet.
14	
15	
16	
17	
18	

KCTP3 180106.GPJ March 26, 2019

Penny Lane II & III
Redmond, WA

Logged by: BCY
Approved by: JHS

associated earth sciences incorporated

Project No. 180106E001

2/28/19

LOG OF EXPLORATION PIT NO. EP-9

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION** Elev: 54 ft
	Alluvium
1	Medium dense, dry, tannish brown, silty, fine SAND, some gravel; scattered organics (rootlets) (SM).
2	
3	Medium dense, dry, tan, gravelly, fine to medium SAND, trace silt; scattered organics (rootlets) (SP).
4	
5	
6	Medium dense, dry, tan, medium to coarse sandy, GRAVEL, trace silt; scattered organics (rootlets) (GW).
7	
8	As above; cobbles (up to 6 inches) (GW).
9	
10	As above; cobbles (up to 4.5 inches) (GW).
11	Bottom of exploration pit at depth 10.5 feet No seepage. Minor caving at 4 feet, moderate caving at 9 feet.
12	
13	
14	
15	
16	
17	
18	

Penny Lane II & III
Redmond, WA

Logged by: BCY
Approved by: JHS

associated earth sciences incorporated

Project No. 180106E001

2/28/19

LOG OF EXPLORATION PIT NO. EP-10

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

Depth (ft)	DESCRIPTION — Elev: 54 ft
	Fill
	Loose, moist, gray, GRAVEL (~3/8 inch) (GP).
1	**Topsoil / Fill**
	Loose, dry, reddish brown, silty, fine SAND, trace to some gravel; scattered organics (rootlets) (SM).
2	
3	**Alluvium**
4	Loose to medium dense, slightly moist, tannish brown, medium sandy, GRAVEL, trace silt; scattered cobbles (GW).
5	
6	Medium dense to dense, moist, gray, medium to coarse very sandy, GRAVEL, some cobbles (up to 6 inches), trace silt (GW).
7	
8	Dense to medium dense, moist, gray, medium to coarse sandy, GRAVEL, some cobbles (up to 7 inches), trace silt (GW).
9	
10	
11	Dense, moist, gray to tan, medium to coarse sandy, GRAVEL, trace cobbles (up to 5 inches), trace silt; discontinuous silt interbed (5 inches thick) at 11 feet, transitions back to sandy gravel (GW).
12	
13	Bottom of exploration pit at depth 12 feet No seepage. Caving 5 to 12 feet.
14	
15	
16	
17	
18	

Penny Lane II & III
Redmond, WA

Logged by: BCY
Approved by: JHS

associated earth sciences incorporated

Project No. 180106E001

2/28/19

associated earth sciences incorporated

Exploration Log

Project Number	Exploration Number	Sheet
180106E001	EB-1	1 of 1

Project Name	Penny Lane	Ground Surface Elevation (ft)	54
Location	Redmond, WA	Datum	NAVD 88
Driller/Equipment	Geologic Drill / Walk-behind or XL Trailer Rig	Date Start/Finish	3/28/18,3/28/18
Hammer Weight/Drop	140# / 30"	Hole Diameter (in)	6 inches

Depth (ft)	S T	Samples	DESCRIPTION	Well Completion	Water Level	Blows/6"	Blows/Foot	Other Tests
			Topsoil - 6 inches					
			Fill					
		S-1	Moist, brown to reddish brown, fine to medium SAND, some silt, some gravel; occasional organics (SP-SM).			2 2 2	4	
5			**Alluvium**					
		S-2	Moist, light brown to light brownish gray, fine to medium SAND, some gravel, trace silt; massive (SP).			2 5 4	9	
		S-3	Moist, light brown, fine SAND, trace gravel, trace silt' massive (SP).			1 2 10	12	
10		S-4	Moist, brown and gray, gravelly, fine to coarse SAND, trace silt; massive (SP).			6 12 17	29	
			Cobbles in drill cuttings, erratic drill action observed at 13 feet.					
15		S-5	Moist, brown and brownish gray, gravelly, fine to medium SAND, trace silt; broken rock in sampler (SP).			10 21 18	39	
			Very gravelly drilling observed at 17 feet.					
20		S-6	Very moist, brownish gray, gravelly, fine to medium SAND, trace silt; sampler tip is wet; broken rock in sampler (SP).		▼	14 17 21	38	
			Pre-Fraser Fine Grained Sediments					
			"Sticky" drilling observed at 23 feet.					
25		S-7	Very moist, gray to dark gray, SILT, trace sand, trace gravel; trace gravel present as dropstones; minor mica flakes (ML).			6 14 30	44	
			Very hard drilling at 27 feet.					
30		S-8	Very moist, gray to dark gray, SILT, trace gravel; trace gravel present as dropstones (ML).			22 25 32	57	
			Bottom of exploration boring at 31.5 feet					
35								

Blows/Foot scale: 10 20 30 40

Sampler Type (ST):

- 2" OD Split Spoon Sampler (SPT)
- 3" OD Split Spoon Sampler (D & M)
- Grab Sample
- No Recovery
- Ring Sample
- Shelby Tube Sample
- M - Moisture
- Water Level ()
- Water Level at time of drilling (ATD)

Logged by: TG
Approved by: JHS

associated earth sciences incorporated

Exploration Log

Project Number	Exploration Number	Sheet
180106E001	EB-2	1 of 1

Project Name	Penny Lane	Ground Surface Elevation (ft)	53
Location	Redmond, WA	Datum	NAVD 88
Driller/Equipment	Geologic Drill / Walk-behind or XL Trailer Rig	Date Start/Finish	3/28/18,3/28/18
Hammer Weight/Drop	140# / 30"	Hole Diameter (in)	6 inches

Depth (ft)	S T	Samples	DESCRIPTION	Blows/6"	Blows/Foot
0			**Topsoil - 6 inches**		
			Fill		
		S-1	Moist, light to dark brown, fine to medium SAND, some gravel, some silt; broken rock in sampler; occasional organics (SP-SM). Very cobbly drilling observed 3 to 4 feet; plastic in drill cuttings. Driller repositioned.	12 20 17	47
5		S-2	As above. Very cobbly drilling observed 5 to 7.5 feet.	11 17 30	47
			Bottom of exploration boring at 7 feet Refusal due to cobbles.		
10					
15					
20					
25					
30					
35					

Columns: Graphic Symbol, Well Completion, Water Level, Other Tests. Blows/Foot scale: 10, 20, 30, 40

Sampler Type (ST):
- 2" OD Split Spoon Sampler (SPT)
- 3" OD Split Spoon Sampler (D & M)
- Grab Sample
- No Recovery
- Ring Sample
- Shelby Tube Sample
- M - Moisture
- Water Level ()
- Water Level at time of drilling (ATD)

Logged by: TG
Approved by: JHS

associated earth sciences incorporated

Exploration Log

Project Number	Exploration Number	Sheet
180106E001	EB-3	1 of 1

Project Name	Penny Lane	Ground Surface Elevation (ft)	53
Location	Redmond, WA	Datum	NAVD 88
Driller/Equipment	Geologic Drill / Walk-behind or XL Trailer Rig	Date Start/Finish	3/29/18,3/29/18
Hammer Weight/Drop	140# / 30"	Hole Diameter (in)	6 inches

Depth (ft)	S T	Samples	DESCRIPTION	Blows/6"	Blows/Foot
			Topsoil - 4 inches		
			Alluvium		
		S-1	Moist, light brown to dark brown, fine to medium SAND, some silt, some gravel, ranging to silty, SAND; occasional organics (SP-SM/SM).	3 5 5	10
5		S-2	Moist, light brown, gravelly, fine to medium SAND, some silt; large rock in sampler tip, pushing rock; low recovery (SP-SM). Very rough drilling observed 5 to 7.5 feet; large gravel and cobbles present in drill cuttings.	9 15 15	30
		S-3	As above, sample may not be representative; large rock in sampler tip, pushing rock, low recovery. Very cobbly drilling observed 7.5 to 11 feet.	7 19 12	31
10		S-4	Moist, light brown, gravelly, fine to medium SAND, trace silt (SP).	14 19 18	37
			Driller used rock spike to break up cobbles.		
			Bottom of exploration boring at 13 feet		
15					
20					
25					
30					
35					

Sampler Type (ST):

- 2" OD Split Spoon Sampler (SPT)
- 3" OD Split Spoon Sampler (D & M)
- Grab Sample
- No Recovery
- Ring Sample
- Shelby Tube Sample
- M - Moisture
- Water Level ()
- Water Level at time of drilling (ATD)

Logged by: TG
Approved by: JHS

associated earth sciences incorporated	Exploration Log		
	Project Number	Exploration Number	Sheet
	180106E001	EB-4	1 of 1

Project Name	Penny Lane	Ground Surface Elevation (ft)	53
Location	Redmond, WA	Datum	NAVD 88
Driller/Equipment	Geologic Drill / Walk-behind or XL Trailer Rig	Date Start/Finish	3/29/18,3/29/18
Hammer Weight/Drop	140# / 30"	Hole Diameter (in)	6 inches

Depth (ft)	S T	Samples	Graphic Symbol	DESCRIPTION	Well Completion	Water Level	Blows/6"	Blows/Foot (10 20 30 40)	Other Tests
				Grass Turf / Topsoil - 4 inches					
				Fill					
		S-1		Very moist, gray to dark brown, very silty, fine SAND, trace gravel, trace organics (SM).			2 6 4	▲10	
5		S-2		Broken rock in sampler, sample not representative.			16 30 9	▲39	
				Cobbly drilling observed at 6 feet; driller noted pounding on rock, pushing rock, low recovery.					
		S-3		Moist, light brownish gray, sandy, SILT, trace gravel, ranges to silty, SAND; broken rock in sampler; contains pockets of dark brown, silty, sand (SM-ML). Driller used rock spike to break up cobbles, driller could not advance drill.			10 20 14	▲34	
10				Bottom of exploration boring at 9 feet					
15									
20									
25									
30									
35									

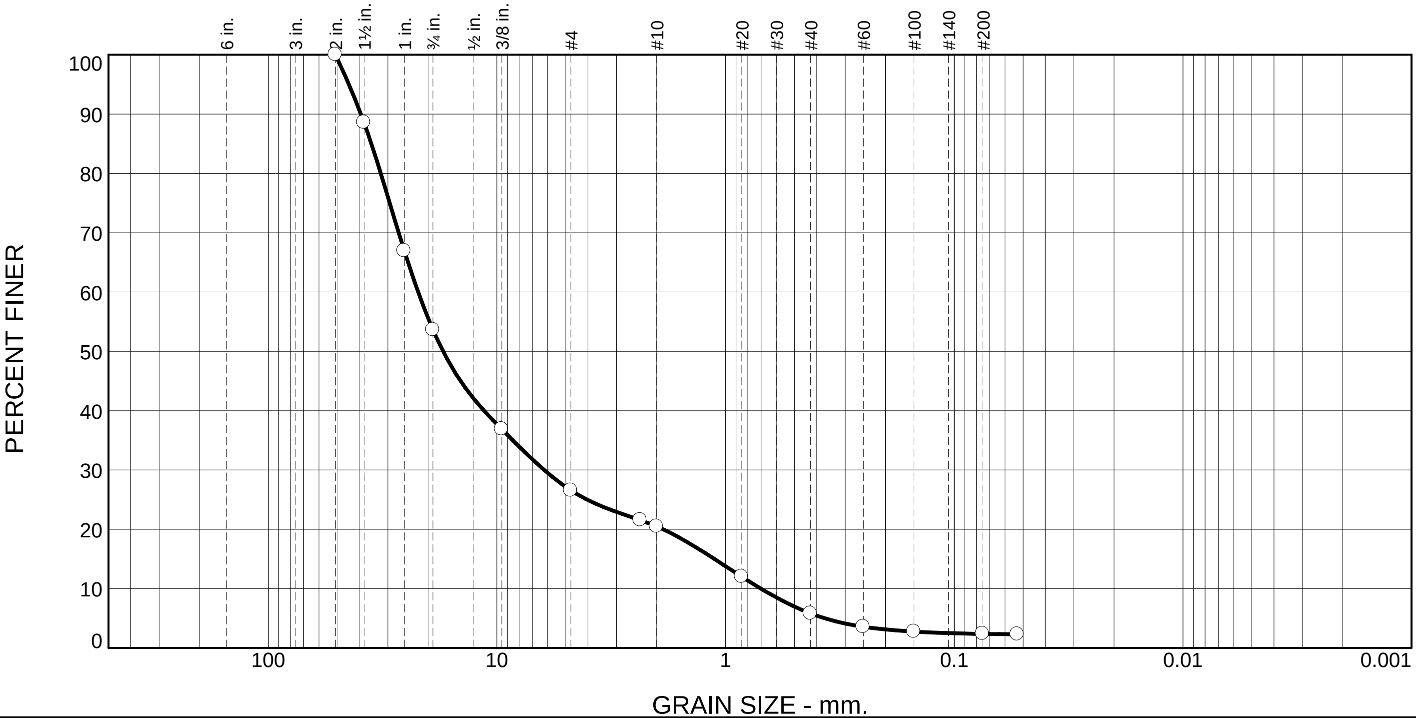
Sampler Type (ST):

2" OD Split Spoon Sampler (SPT)	No Recovery	M - Moisture	**Logged by:** TG
3" OD Split Spoon Sampler (D & M)	Ring Sample	Water Level ()	**Approved by:** JHS
Grab Sample	Shelby Tube Sample	Water Level at time of drilling (ATD)	

APPENDIX B

Laboratory Testing Data

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	46.4	27.0	6.1	14.7	3.4	2.4	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2	100.0		
1.5	88.6		
1	66.9		
.75	53.6		
.375	36.9		
#4	26.6		
#8	21.5		
#10	20.5		
#20	12.0		
#40	5.8		
#60	3.6		
#100	2.8		
#200	2.4		
#270	2.3		

* (no specification provided)

Material Description

sandy, GRAVEL, trace silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= GW **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 39.3254 D_{85}= 35.4198 D_{60}= 22.1124
D_{50}= 17.1943 D_{30}= 6.2155 D_{15}= 1.1201
D_{10}= 0.7012 C_u= 31.53 C_c= 2.49

Remarks

Collected by: TG

Date Received: 04/23/2018 **Date Tested:** 04/24/2018

Tested By: BN

Checked By: BLB

Title:

Location: Onsite
Sample Number: EP-1 **Depth:** 10'

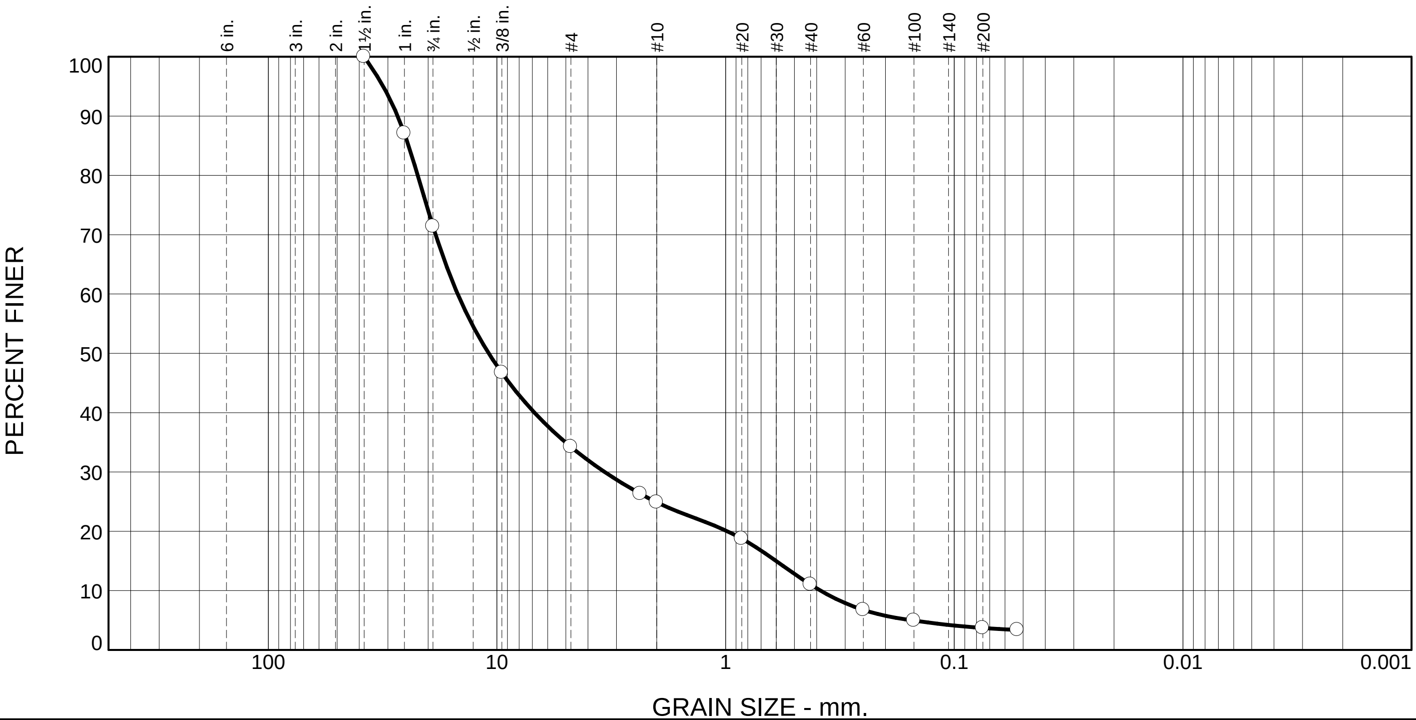
Date Sampled: 04/21/2018

associated earth sciences incorporated

Client: Ichijo USA Co. LTD
Project: Penny Lane II

Project No: 180106 E001 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	28.6	37.2	9.3	13.9	7.3	3.7	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5	100.0		
1	87.1		
.75	71.4		
.375	46.7		
#4	34.2		
#8	26.3		
#10	24.9		
#20	18.8		
#40	11.0		
#60	6.7		
#100	4.9		
#200	3.7		
#270	3.4		

* (no specification provided)

Material Description

very sandy, GRAVEL, trace silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= GW **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 27.1612 D_{85}= 24.3455 D_{60}= 14.8443
D_{50}= 10.8623 D_{30}= 3.3800 D_{15}= 0.6015
D_{10}= 0.3847 C_u= 38.59 C_c= 2.00

Remarks

Collected by: TG

Date Received: 04/23/2018 **Date Tested:** 04/24/2018

Tested By: BN

Checked By: BLB

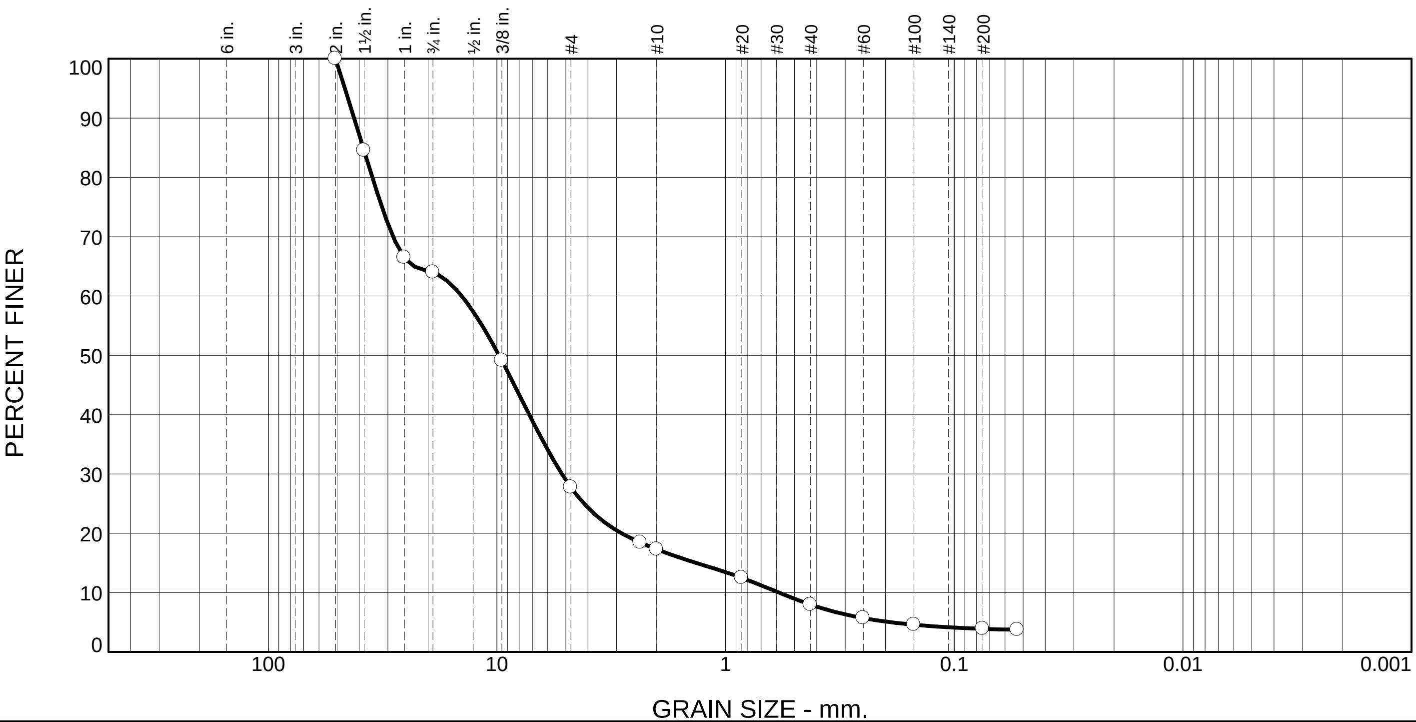
Title:

Location: Onsite
Sample Number: EP-4 **Depth:** 9'
Date Sampled: 04/21/2018

associated earth sciences incorporated

Client: Ichijo USA Co. LTD
Project: Penny Lane II
Project No: 180106 E001 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	36.0	36.3	10.4	9.3	4.1	3.9	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2	100.0		
1.5	84.5		
1	66.5		
.75	64.0		
.375	49.1		
#4	27.7		
#8	18.5		
#10	17.3		
#20	12.5		
#40	8.0		
#60	5.7		
#100	4.6		
#200	3.9		
#270	3.7		

* (no specification provided)

Material Description

sandy, GRAVEL, trace silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=**

Classification

USCS (D 2487)= GP **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 42.1473	D_{85}= 38.4367	D_{60}= 14.2579
D_{50}= 9.7984	D_{30}= 5.2005	D_{15}= 1.3426
D_{10}= 0.5842	C_u= 24.41	C_c= 3.25

Remarks

Collected by: TG

Date Received: 04/23/2018 **Date Tested:** 04/24/2018

Tested By: BN

Checked By: BLB

Title:

Location: Onsite

Sample Number: EP-5 **Depth:** 4'

Date Sampled: 04/21/2018

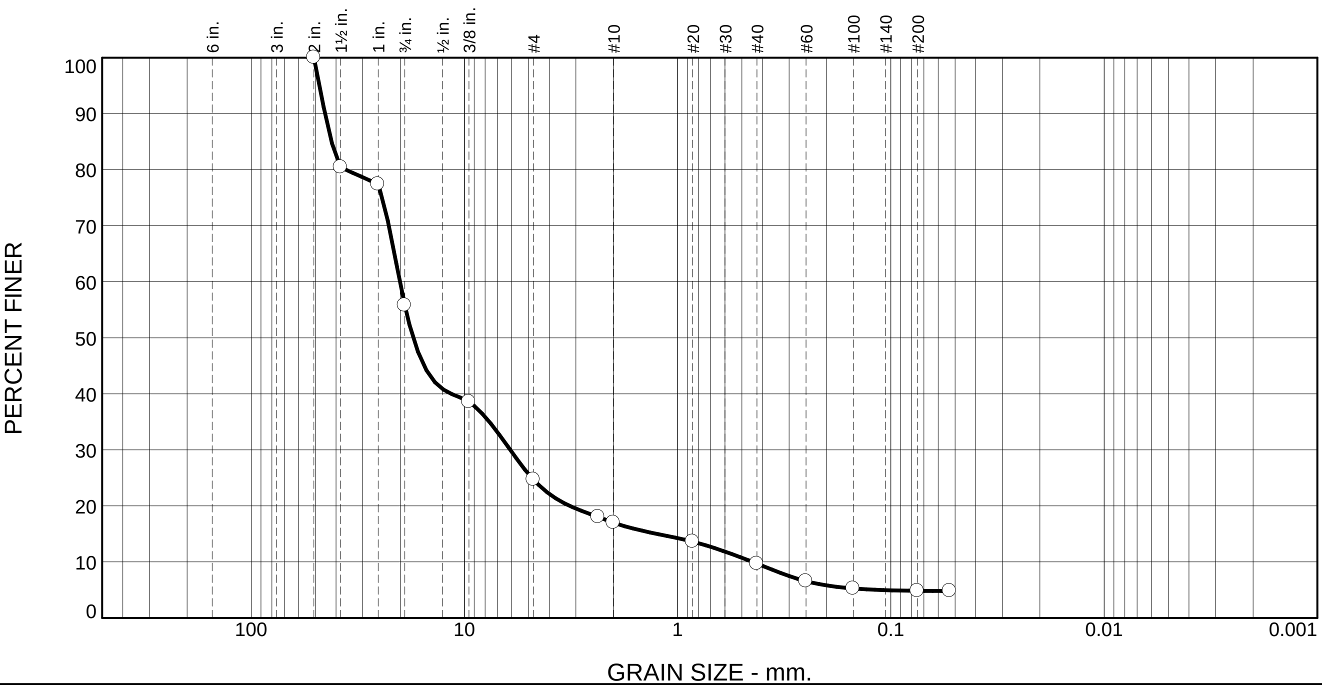
a s s o c i a t e d
e a r t h s c i e n c e s
i n c o r p o r a t e d

Client: Ichijo USA Co. LTD

Project: Penny Lane II

Project No: 180106 E001 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	44.2	31.1	7.7	7.3	4.9	4.8	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2	100.0		
1.5	80.4		
1	77.4		
.75	55.8		
.375	38.6		
#4	24.7		
#8	18.0		
#10	17.0		
#20	13.6		
#40	9.7		
#60	6.6		
#100	5.3		
#200	4.8		
#270	4.8		

* (no specification provided)

Material Description

Sandy GRAVEL Trace Silt

Atterberg Limits (ASTM D 4318)

PL= **LL=** NV **PI=**

Classification

USCS (D 2487)= GP **AASHTO (M 145)=**

Coefficients

D_{90}= 45.0819 D_{85}= 41.9814 D_{60}= 20.0854
D_{50}= 17.3819 D_{30}= 6.0998 D_{15}= 1.2481
D_{10}= 0.4454 C_u= 45.10 C_c= 4.16

Remarks

Date Received: 3-6-19 **Date Tested:** 3-6-19

Tested By: BP

Checked By: AWR

Title:

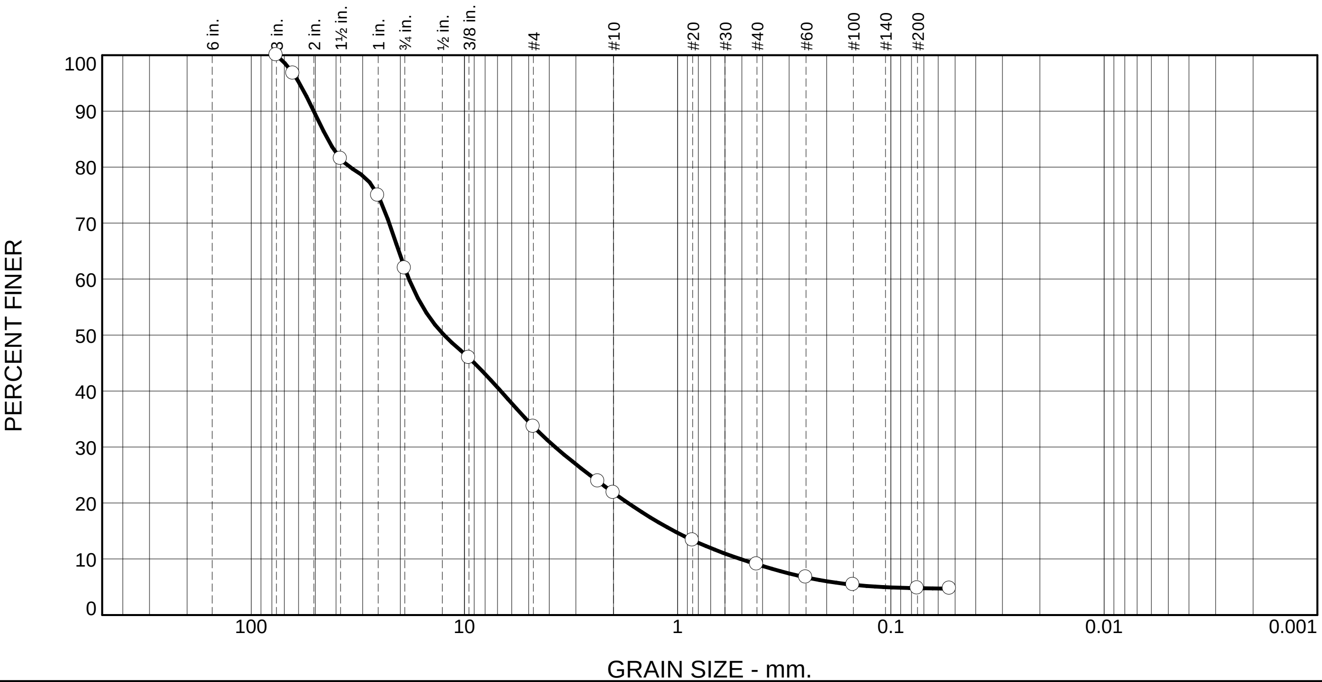
Location: Onsite
Sample Number: EP-6 **Depth:** 6.5'
Date Sampled: 3-6-19

associated earth sciences incorporated

Client: Ichijo USA Co. LTD
Project: Penny Lane II

Project No: 180106 E001 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	38.1	28.3	11.8	12.7	4.3	4.8	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3	100.0		
2.5	96.7		
1.5	81.5		
1	74.9		
.75	61.9		
.375	45.9		
#4	33.6		
#8	23.9		
#10	21.8		
#20	13.4		
#40	9.1		
#60	6.7		
#100	5.4		
#200	4.8		
#270	4.7		

* (no specification provided)

Material Description

Sandy GRAVEL Trace Silt

Atterberg Limits (ASTM D 4318)

PL= **LL=** NV **PI=**

Classification

USCS (D 2487)= GW **AASHTO (M 145)=**

Coefficients

D_{90}= 50.9176 D_{85}= 43.7764 D_{60}= 18.1938
D_{50}= 12.4574 D_{30}= 3.7558 D_{15}= 1.0388
D_{10}= 0.5077 C_u= 35.84 C_c= 1.53

Remarks

Date Received: 3-6-19 **Date Tested:** 3-6-19

Tested By: BP

Checked By: AWR

Title:

Location: Onsite
Sample Number: EP-7 **Depth:** 8'

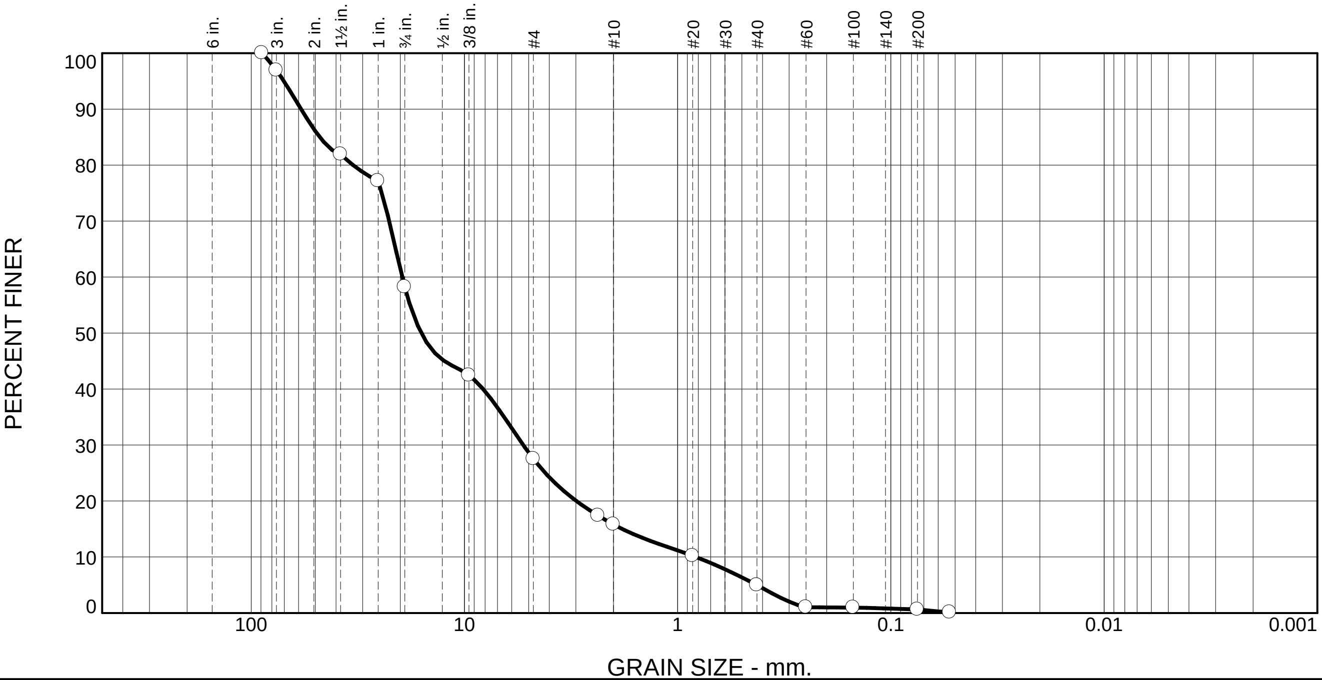
Date Sampled: 3-6-19

associated earth sciences incorporated

Client: Ichijo USA Co. LTD
Project: Penny Lane II

Project No: 180106 E001 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
3.1	38.7	30.7	11.7	10.8	4.4	0.6	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3.5	100.0		
3	96.9		
1.5	81.9		
1	77.2		
.75	58.2		
.375	42.4		
#4	27.5		
#8	17.4		
#10	15.8		
#20	10.2		
#40	5.0		
#60	1.0		
#100	1.0		
#200	0.6		
#270	0.1		

* (no specification provided)

Material Description

Sandy GRAVEL Trace Silt

Atterberg Limits (ASTM D 4318)

PL= **LL=** NV **PI=**

Classification

USCS (D 2487)= GW **AASHTO (M 145)=**

Coefficients

$D_{90}=$ 58.3543 $D_{85}=$ 47.7219 $D_{60}=$ 19.5810
$D_{50}=$ 15.9397 $D_{30}=$ 5.2990 $D_{15}=$ 1.8196
$D_{10}=$ 0.8222 $C_u=$ 23.82 $C_c=$ 1.74

Remarks

Date Received: 3-6-19 **Date Tested:** 3-6-19

Tested By: BP

Checked By: AWR

Title:

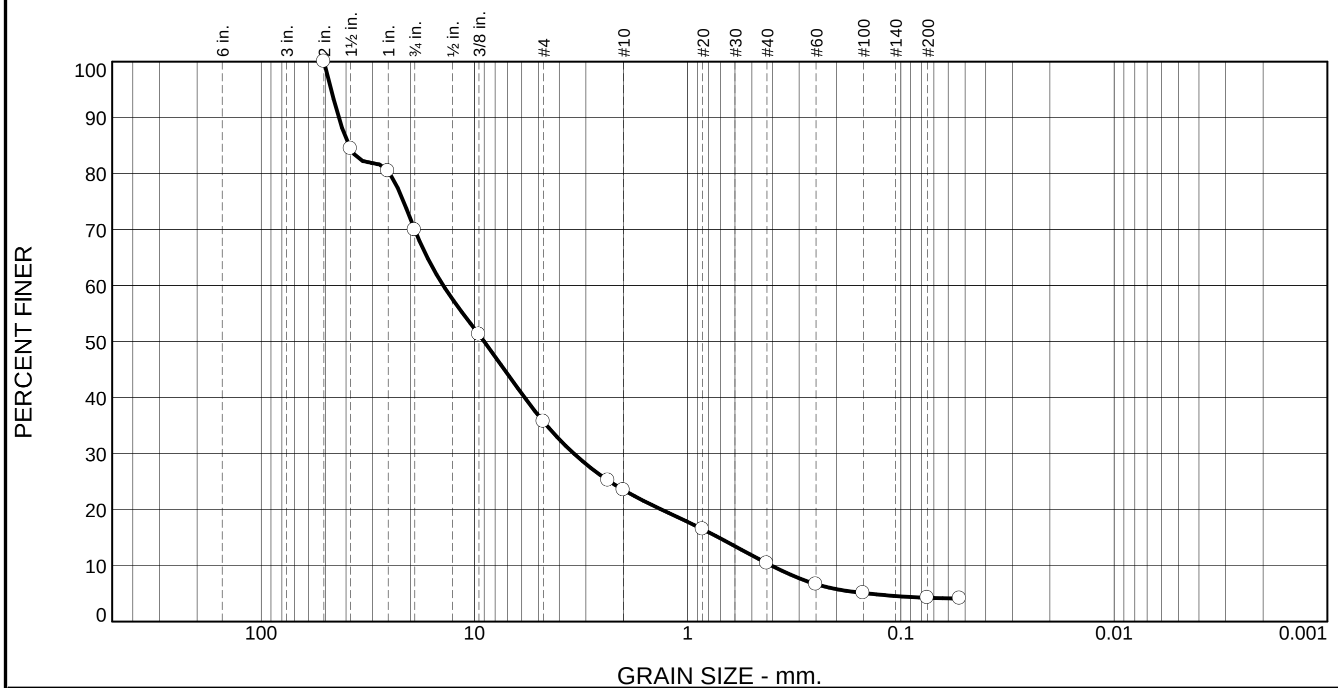
Location: Onsite
Sample Number: EP-8 **Depth:** 8'
Date Sampled: 3-6-19

associated earth sciences incorporated

Client: Ichijo USA Co. LTD
Project: Penny Lane II

Project No: 180106 E001 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	30.1	34.2	12.2	13.1	6.2	4.2	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2	100.0		
1.5	84.5		
1	80.5		
.75	69.9		
.375	51.3		
#4	35.7		
#8	25.2		
#10	23.5		
#20	16.5		
#40	10.4		
#60	6.7		
#100	5.1		
#200	4.2		
#270	4.1		

* (no specification provided)

Material Description

Sandy GRAVEL Trace Silt

Atterberg Limits (ASTM D 4318)

PL= **LL=** NV **PI=**

Classification

USCS (D 2487)= GW **AASHTO (M 145)=**

Coefficients

D_{90}= 43.2645 D_{85}= 38.7489 D_{60}= 13.9997
D_{50}= 9.0011 D_{30}= 3.4194 D_{15}= 0.7146
D_{10}= 0.4054 C_u= 34.53 C_c= 2.06

Remarks

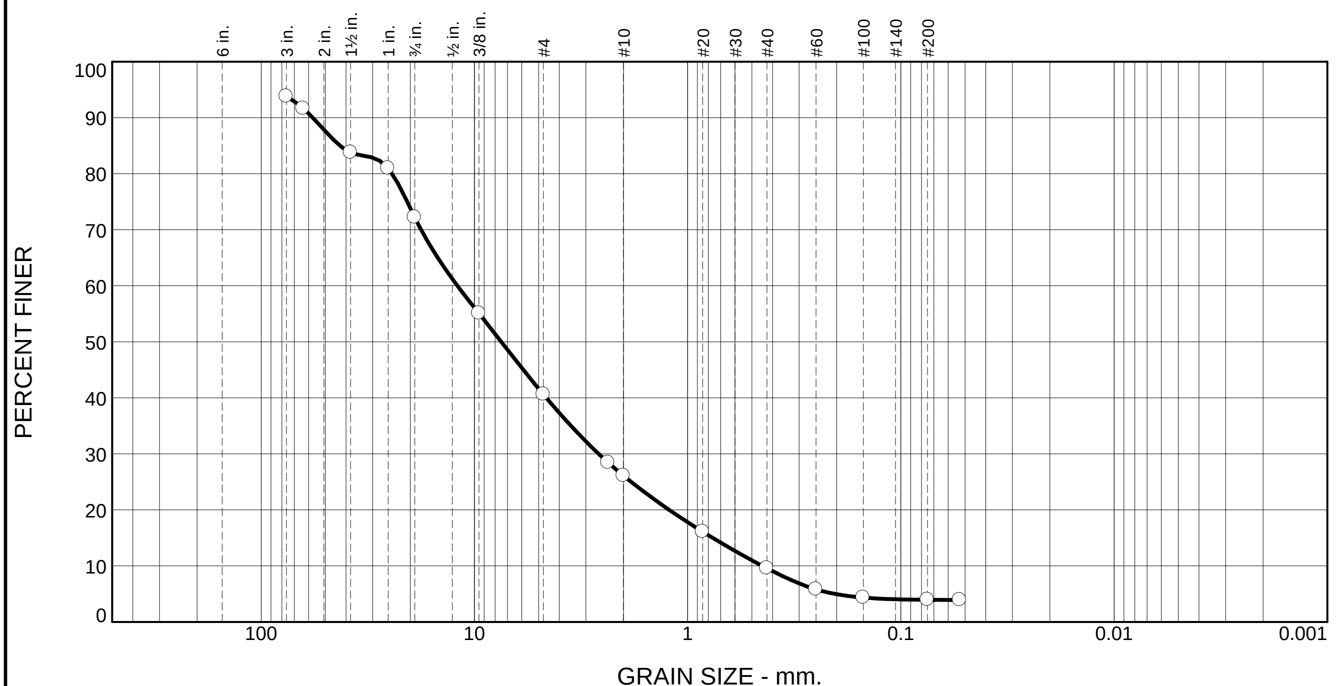
Date Received: 3-6-19 **Date Tested:** 3-6-19
Tested By: BP
Checked By: AWR
Title:

Location: Onsite
Sample Number: EP-9 **Depth:** 6'
Date Sampled: 3-6-19

associated earth sciences incorporated

Client: Ichijo USA Co. LTD
Project: Penny Lane II
Project No: 180106 E001 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
	21.6	31.6	14.5	16.5	5.7	3.9	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3	93.8		
2.5	91.6		
1.5	83.8		
1	81.0		
.75	72.2		
.375	55.1		
#4	40.6		
#8	28.5		
#10	26.1		
#20	16.1		
#40	9.6		
#60	5.8		
#100	4.4		
#200	3.9		
#270	3.9		

* (no specification provided)

Material Description

Very SAndy GRAVEL Trace Silt

Atterberg Limits (ASTM D 4318)

PL= **LL=** NV **PI=**

Classification

USCS (D 2487)= GW **AASHTO (M 145)=**

Coefficients

D_{90}= 57.2829	D_{85}= 42.6874	D_{60}= 12.0207
D_{50}= 7.4856	D_{30}= 2.6140	D_{15}= 0.7624
D_{10}= 0.4463	C_u= 26.93	C_c= 1.27

Remarks

Date Received: 3-6-19 **Date Tested:** 3-6-19

Tested By: BP

Checked By: AWR

Title:

Location: Onsite
Sample Number: EP-10 **Depth:** 6'
Date Sampled: 3-6-19

associated earth sciences incorporated

Client: Ichijo USA Co. LTD
Project: Penny Lane II

Project No: 180106 E001 **Figure**